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Izozogia nellii (Zygophyllaceae), Nuevo Género y Especie del Gran Chaco de Santa Cruz (Bolivia)

Gonzalo Navarro

Departamento de Biología Vegetal II (Botánica), Facultad de Farmacia, Universidad Complutense, 28040-Madrid, España

RESUMEN. Durante el estudio fitosociológico y geobotánico que actualmente realizamos sobre el Gran Chaco en Bolivia, se colectó material de un arbolito de la familia Zygophyllaceae, que se propone como nuevo género y especie, *Izozogia nellii*, diferenciable de los afines por su androceo muy heterométrico (5 + 5) y fruto indehiscente ovoide-curvado, ni anguloso ni alado, con cavidades completamente soldadas que contienen 0–3 semillas cada una. El nuevo taxon se describe, se ilustra y se compara con los afines.

ABSTRACT. During phytosociological and geobotanical research in the Bolivian Gran Chaco, a shrubby-arborescent member of the Zygophyllaceae was collected and is described here as a new genus and species, *Izozogia nellii*. It is distinguished from its relatives by its strongly heterometric stamens (5 + 5) and the indehiscent, ovate-curved, unwinged, unangled fruits with completely fused cavities, each one containing 0–3 seeds. The new taxon is described, illustrated, and compared with its relatives.

Izozogia nellii G. Navarro, gen. et sp. nov. TIPO: Bolivia. Departamento de Santa Cruz: Provincia Cordillera, Izozog, estancia Cachari, 400 m, en bosque bajo chaqueño medianamente drenado, 5 ene. 1993, *G. Navarro 1613* (holótipo, USZ; isótipos, BOLV, LPB, MO). Figura 1.

Arbores parvae pluricaules (1–)2–4(–6) m altae. Folia pinnata opposita, 20–30 mm longa et 20–25 mm lata. Foliola 10–14, oblongo-linearia et resinosa. Stipulae minutae, caducae. Flores solitarii, axillares; petala 5, breve caduca, late obovata et unguiculata, alba, (18–)19–22(–23) mm longa et (10–)11–13(–14) mm lata. Stamina 10, inaequalia, 5 longiora et 5 minoria, filamenta curvata. Squama staminalis nulla. Ovarium oblongo-fusiforme, 5-sulcatum, glabrum. Carpela 5. Ovula in loculis ca. 10. Fructus capsularis, coriaceus, indehiscens, ovato-ellipticus, acutus, curvatus, 5-sulcatus, (12–)15–20(–23) mm longus et (12–)14–17(–19) mm latus, juventute virides-cens, maturitate nigrescentis resinosusque. Loculi 5 toti connati, inaequale. Semina in loculis (0–)1–3, trigono-ellipsoidea, 11–16 mm longa et 3.5–6.5 mm lata. Albumen carnoso-resinosum. Embryo rectus, cotiledonibus foliaceis.

Arbusto o arbolito decíduo, de (1–)2–4(–6) m de alto. Ramas y ramitas cilíndricas (Fig. 1A), cuando jóvenes algo pubescentes, enseguida glabras, algunas algo espinescentes, con corteza grisácea y longitudinalmente surcado-rugosa; internudos (5–)10–20(–25) mm de long. y 2–7 mm de ancho. Nudos con 2 pulvínulos prominentes y opuestos, inicialmente muy tomentosos, luego casi glabros, de (1.5–)2–4(–5) mm de diám. Hojas (Fig. 1A, 1B, 1C) verticilado-opuestas, 2–4 en cada nudo, de 20–30 mm de long. y 20–25 mm de ancho; folíolos sésiles, los basales alternos a subopuestos, el resto alternos, en número de (10–)12–14(–17), linear-oblongos con base asimétrica y ápice obtuso o algo agudo, de (5–)7–12(–15) mm de long. y 2–3(–3.3) mm de ancho, inicialmente con pubescencia aplicado-serícea especialmente en el envés, posteriormente casi glabros y más o menos resinosos; pecíolo de 2–3.5 mm de largo, cilíndrico o algo anguloso, al principio densamente seríceo-pubescente, luego algo pubescente, con pelos aplicados; raquis de (13–)15–20(–23) mm de largo, cortamente mucronado, basalmente cilíndrico, ap-

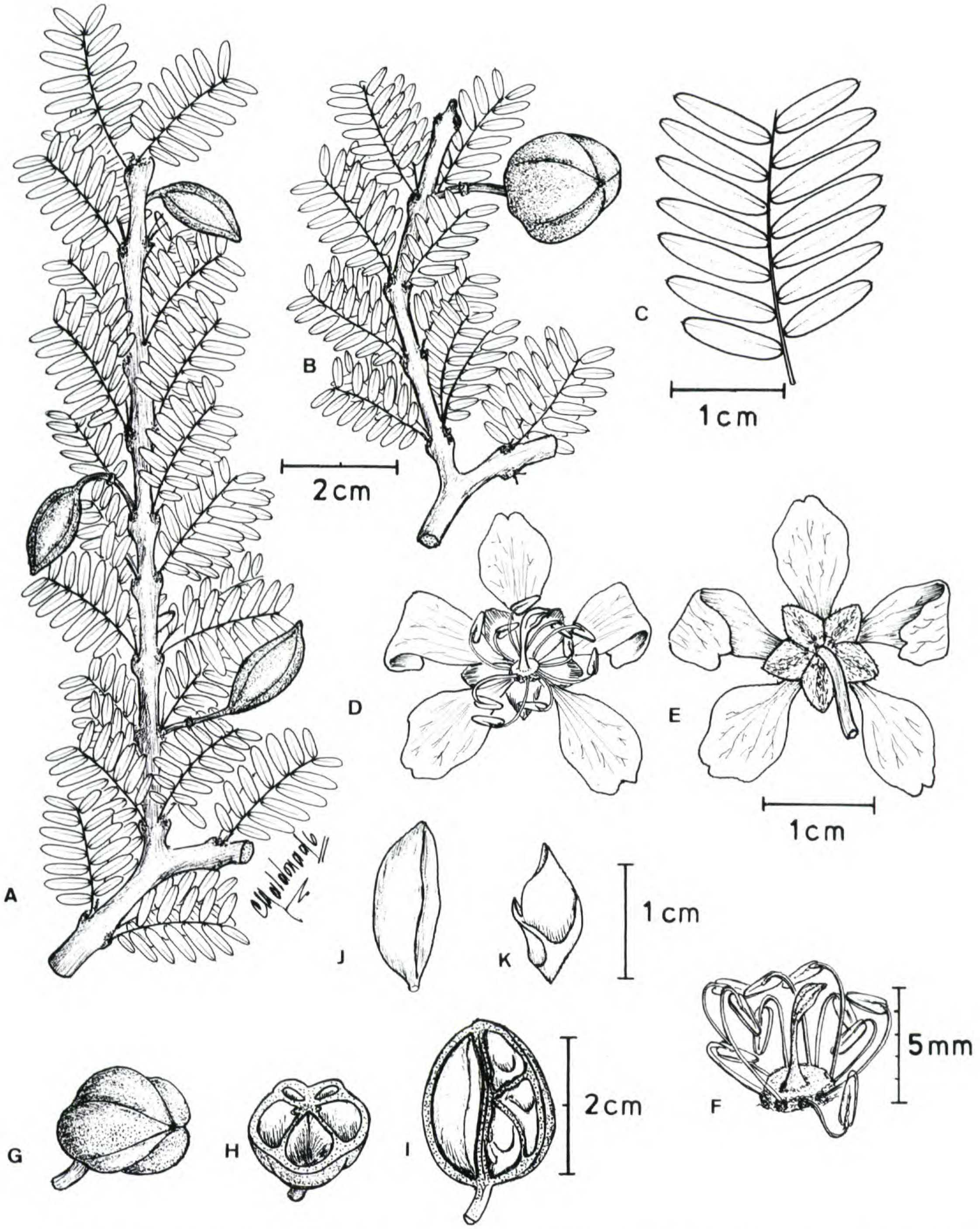

Figura 1. *Izozogia nellii* G. Navarro. —A. Rama con frutos submaduros. —B. Detalle de rama con un fruto maduro. —C. Detalle de hoja con 14 folíolos. —D. Flor. —E. Sépalos y pedicelo. —F. Detalle de androceo y gineceo. —G. Fruto maduro. —H. Sección transversal del fruto. —I. Sección longitudinal del fruto. —J. Semilla de cavidad inferior. —K. Semilla de cavidad superior. Dibujo A, de *G. Navarro 2461.* Dibujos B, C, G, H, I, J, K, de *G. Navarro 1613.* Dibujos D, E, F, de *G. Navarro, N. De la Barra y E. Gutierrez 2612.*

icalmente 3–4-anguloso, al principio densamente seríceo-pubescente, luego casi glabro; estípulas diminutas, caducas, ovado-agudas, densamente seríceo-pubescentes, de 0.3–0.5 mm de long. Flores (Fig. 1D, 1E, 1F) axilares y solitarias, apareciendo generalmente antes que las hojas, de 45–60 mm de diám. en antesis; pedicelos de (0.2–)0.5–2(–2.5) mm de long., densamente seríceo-pubescentes; botones florales sésiles o muy cortamente pedicelados; sépalos (Fig. 1E) 5, heterométricos, insertos entre los pétalos, libres, imbricados, ovado-obtusos, cóncavos, con pubescencia corta y aplicada en la zona dorsal media y algo ciliados en los márgenes, 2 menores, de 3.5–4 mm de largo y 2.7–3 mm de ancho, los 3 restantes mayores, de 5.5–6 mm de largo y 4–4.5 mm de ancho; pétalos (Fig. 1D, 1E) 5, de (18–)19–22(–23) mm de largo y (10–)11–13(–14) mm de ancho, obovado-espatulados y unguiculados, enteros o emarginados apicalmente con emarginación de 0.5–1.5 mm de profundidad, uña de 2–3 mm de largo, color blanco puro excepto la uña que es rosado-fucsia o amarillenta. Estambres (Fig. 1F) heterométricos (5 + 5), con filamentos cilíndrico-filiformes recurvados en forma de cayado y desprovistos de escamas, insertos en el receptáculo, anteras biloculares dorsifijas en el tercio basal con dehiscencia longitudinal; 5 estambres más largos, de 8.5–10.5 mm de long., con filamentos de 6–8 mm de largo y 0.4–0.6 mm de diám., de color blanco excepto la base que es amarillenta con un anillo de color fucsia por encima, anteras 2.5–3 mm de largo y 1 mm de ancho, de color amarillento a castaño; los 5 estambres restantes menores, de 6.5–8.5 mm de largo, con filamentos de 4–6 mm de largo y 0.4–0.5 mm de diám. de color blanco excepto la base que es amarillenta, anteras 2.5–3 mm de largo y 1 mm de ancho, de color amarillento a castaño. Ovario súpero, glabro, oblongo-fusiforme, con 5 surcos longitudinales separados por cordones redondeados, al comienzo de la antesis ercto, de 1–1.5 mm de long. y 0.6–0.8 mm de diám., con ginóforo de 0.5 mm de largo; al final de la antesis oblícuo a horizontal, de 4–5 mm de largo y 1.2–1.5 mm de diám., con ginóforo elongado de 4–6 mm de long.; carpelos 5, soldados, cada uno con aproximadamente 10 óvulos anátropos de 0.1–0.2 mm de long., péndulo-biseriados, con placentación axilar; estilo poco diferenciado, zona estigmática cónico-obtusa; disco cónico-truncado, de 1.5–1.8 mm de diám. y 0.5 mm de altura. Fruto (Fig. 1G, 1H, 1I) cápsula indehiscente de (12–)15–20(–23) mm de largo y (12–)14–17(–19) mm de ancho, glabra, ovado-elíptica, aguda, algo incurvada, convexa adaxialmente y aplanada abaxialmente, con 5 surcos longitudinales separados por columnas redondeadas y obtusas, heterométricas; pericarpio grueso y coriáceo, primero verdoso, en la madurez de color oscuro casi negro, resinoso; 5 cavidades soldadas, heterométricas, las 3 superiores (adaxiales), mayores, con (1–)3 semillas y las 2 inferiores (abaxiales), menores, con 0–1 semilla; semillas (Fig. 1J) de las cavidades inferiores de 14–16 mm de largo y 5–6.5 mm de diám., oblongas o hemielípticas, agudas, de sección ovado-trígona; semillas (Fig. 1K) de las cavidades superiores de 11–13 mm de largo y 3.5–4.5 mm de diám., oblongas a hemielípticas, truncadas, de sección ovado-trígona; tegumentos exteriormente lisos, de color pardo-amarillento a verdoso; albumen carnoso-resinoso, rodeando totalmente al embrión; embrión recto, de 9–10 mm de long.; cotiledones linear-oblongos, planos, verdes y foliáceos, de 6.5–7.5 mm de largo y 2–2.6 mm de ancho; hilio de 6–7 mm de long.; funículo de 4–6 mm de largo. Carpóforo de 4–7 mm de largo y 1.5–2 mm de diám. Pedúnculo del fruto de 8–10 mm de largo y 1.5–2 mm de diám.

Nombres vernaculares. "Guayacán negro", "Guayacán."

Etimología. El nuevo género se nombra por referencia a la región del Izozog (departamento de Santa Cruz, Bolivia). La nueva especie está dedicada a Nelly De la Barra Ricáldez.

Parátipos. BOLIVIA. **Departamento de Santa Cruz:** Provincia Cordillera, Arenales de Guanacos, proximidades del puesto ganadero Agua Fea, 420 m, en depresiones interdunares con suelos franco-limosos, 10 nov. 1994, *G. Navarro* 2461 (USZ); Planta de Gas de YPFB sobre el río Grande, 400 m, en bosque chaqueño seco, a 55 km al sur de la ciudad de Santa Cruz, 23 oct. 1994, *G. Navarro* 2429 (MO, USZ); Izozog, entre Cuarirenda y Cachari, 20 km al norte de Cuarirenda, 380 m, en bosque bajo chaqueño, 16 nov. 1995, *G. Navarro, N. De la Barra & E. Gutiérrez* 2612 (BOLV, LPB, MAF, MO, USZ); Izozog, entre Laguna Negra y Estancia Toborochi, 19°06′S, 62°20′W, ca. 360 m, bosque seco chaqueño intervenido por ganadería, *I. Vargas, G. Navarro & B. Mostacedo* 1909 (USZ); Izozog, 5 km al este del puesto Cachari hacia Acararenda, 18°55′S, 62°25′W, 350 m, bosque chaqueño sobre suelos arcillosos, 16 en. 1993, *I. Vargas, G. Navarro, B. Mostacedo & D. Justiniano* 1958 (USZ); Curuyuqui, 50 km SE of Santa Cruz on Río Parapetí, upland chaco, 18°45′56″S, 62°13′59″W, 350 m, tree 11 cm DBH, *A. Gentry, R. Foster & M. Peña* 75203 (MO, USZ).

Izozogia nellii es el tipo del nuevo género *Izozogia*, afín al grupo de géneros relacionados (Porter, 1974) *Guaiacum, Porlieria* y *Bulnesia. Izozogia* difiere de *Guaiacum*, el género más próximo, por su fruto indehiscente ni anguloso ni alado, con cavidades completamente soldadas que contienen 0–3 semillas cada una, nunca de color rojo, por sus

estambres marcadamente heterométricos (5 + 5) con filamentos incurvado-filiformes y por sus pétalos de color blanco; además *Guaiacum* es de distribución exclusivamente circum-caribeña, mientras que *Izozogia* aparece restringido al norte del Gran Chaco Boreal. *Porlieria* se separa de *Izozogia* por sus estípulas persistentes, rígido-epinescentes, por los pétalos menores o iguales al doble de la longitud de los sépalos, por los estambres aproximadamente iguales entre sí y provistos de una escama notoria adnata al filamento, por la presencia de 2–4 óvulos sólamente por lóculo del ovario, por el fruto formado por cavidades no soldadas, sólo unidas por el eje central, cada una siempre con una sóla semilla. *Bulnesia* difiere de *Izozogia* por sus estambres aproximadamente iguales entre sí y provistos de una escama notoria adnata al filamento, por la presencia de numerosos óvulos por lóculo del ovario, por su fruto membranoso y dehiscente de lóculos aplanados anchamente alados, sólamente unidos por el eje central, conteniendo cada uno una sóla semilla.

Basándose en la revisión de pliegos de herbario y de la literatura fundamental sobre estos géneros (De Candolle, 1824; Bentham & Hooker, 1862–1867; Engler, 1931; Descole et al., 1940, 1943; Hutchinson, 1967; Porter, 1974; Palacios & Hunziker, 1984) así como la experiencia personal en el campo sobre los mismos, se propone la siguiente clave para separarlos:

1a. Estambres con filamento desprovisto de escama adnata, o con escama relictual; óvulos aproximadamente 10 por lóculo del ovario; fruto con 2–5 cavidades unidas por un eje central y más o menos soldadas por sus paredes frontales y/o laterales; estípulas caducas.
  2a. Estambres aproximadamente homométricos, 8–10, con filamentos rectos, cilíndricos a foliáceo-subulados; fruto cápsula septicida oblonga, marcadamente angulosa o algo alada, con 2–5 cavidades soldadas sólo frontalmente o hasta ⅓ de la longitud de sus paredes laterales; una semilla por cavidad, generalmente de color rojo brillante; endospermo córneo-rimuloso; pétalos azules o púrpura, raramente blanquecinos; género circum-caribeo . . . . . *Guaiacum* L.
  2b. Estambres marcadamente heterométricos (5 + 5) con filamentos incurvos, cilíndrico-filiformes; fruto cápsula indehiscente (carcérulo), ovoide-curvada, ni angulosa ni alada, con cavidades soldadas frontal y lateralmente en su totalidad; con 1–3 semillas por cavidad del fruto, a veces ninguna en 1 o 2 de las cavidades, nunca de color rojo brillante; endospermo carnoso-resinoso; pétalos blanco puro, con uña rosado-fucsia; género del norte del Gran Chaco Boreal . . . *Izozogia* G. Navarro
1b. Estambres con filamentos provistos de una escama adnata muy notoria; óvulos nunca aproximadamente 10 por lóculo del ovario; fruto con 3–5 cavidades unidas sólamente a través del eje central, de paredes no soldadas; estípulas persistentes.
  3a. Estípulas rígidas, subulado-epinescentes; óvulos 2–4 por lóculo del ovario; fruto coriáceo, con 3–5 cavidades esféricas o algo aplanadas nunca aladas; género andino y chaqueño occidental . . . . . *Porlieria* Ruiz & Pavón
  3b. Estípulas anchamente ovado-triangulares, téneras; numerosos óvulos por cada lóculo del ovario; fruto dehiscente, membranoso, con cinco cavidades discoideas o hemielípticas muy aplanadas y anchamente aladas (esquizocarpo alado); género chaqueño, andino y de las tierras bajas del norte de Colombia y Venezuela . . . . . *Bulnesia* C. Gay

Ecología y Distribución

Por los datos existentes hasta el momento, *Izozogia nellii* es un taxon de distribución restringida al norte del Gran Chaco Boreal (región del Izozog, departamento de Santa Cruz, Bolivia) donde muestra una marcada preferencia por los bosques xéricos bajos climácicos, desarrollados sobre suelos medianamente drenados a algo mal drenados de textura franco-limosa, limosa o arcillo-limosa, en altitudes entre 350 y 450 m. Está ausente tanto de los suelos arenosos, como de los suelos arcillosos muy mal drenados y estacionalmente anegables. Aparece en zonas llanas secas y semiáridas termotropicales, con temperatura media anual de unos 24.5°C y precipitación media anual entre 500 y 800 mm. Especies asociadas frecuentemente son, por ejemplo: *Acacia praecox* Grisebach (Mimosaceae), *Aspidosperma quebracho-blanco* Schlechtendal (Apocynaceae), *Bougainvillea praecox* Grisebach (Nyctaginaceae), *Browningia caineana* (Cárdenas) F. Buxbaum (Cactaceae), *Bulnesia bonariensis* Grisebach (Zygophyllaceae), *Capparis salicifolia* Grisebach (Capparidaceae), *Celtis chichape* Weddell (Ulmaceae), *Cereus validus* Haworth (Cactaceae), *Ruprechtia triflora* Grisebach (Polygonaceae), *Stetsonia coryne* (Salm-Dyck) Britton & Rose (Cactaceae) y *Zizyphus mistol* Grisebach (Rhamnaceae).

Floración desde mediados de octubre a finales de noviembre, en relación al comienzo de la época de lluvias, generalmente anterior a la producción de nuevas hojas. Frutos desde noviembre a finales de enero.

Agradecimientos. Agradecimientos a Salvador Rivas-Martínez por su lectura, colaboración y comentarios durante la elaboración del texto.

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Cardamine lojanensis (Brassicaceae), a New Species from Ecuador

Ihsan A. Al-Shehbaz
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. *Cardamine lojanensis*, a new Ecuadorian species from Loja Province, is described and illustrated. Its relationship to the nearest South American species is discussed.

During preparation of the Brassicaceae for the Catalogue of the Vascular Plants of Ecuador, a loan of *Cardamine* from AAU was studied. It included four specimens of a species that did not match any of the known South American members. The new species, *C. lojanensis*, is named after Loja Province, from which it was collected.

Cardamine lojanensis Al-Shehbaz, sp. nov. TYPE: Ecuador. Prov. Loja: Parque Nacional Podocarpus, Cerro Toledo E of Yangana, wet paramo around radio station, 3400–3450 m, 79°6′W, 4°24′S, 26 Feb. 1985, *B. Øllgaard, S. Laegaard, K. Thomsen, K. Korning & T. Illum 58147* (holotype, AAU). Figure 1.

Herba perenna, rhizoma tuberosa squamosa; folia basalia pinnata, petiolis ad basem complanatis triangularibus persistentibus, petiolis rhachibus equali vel duplo longioribus; foliola 6–11-jugata, petiolulata, pinnatifida, laciniata, vel incisa, foliolum terminale foliolis lateralibus similis, cilia 0.06–0.12 mm longae; folia caulina 2–6, forma foliis basalibus similia, rhachidibus petiolis duplo vel quadruplo longioribus; sepala oblonga, glabra, 3–4 mm longa; petala alba, late obovata vel suborbiculata, 8–11 mm longa, 6–7 mm lata, subtruncata vel subemarginata, apiculata, minute unguiculata; pedicelli fructiferi recti, striati, basales 2–2.5 cm longi; fructus linearis, stipitatus, 2.5–5 cm longus; stylus 3–4 mm longus.

Herbs perennial. Rhizomes tuberous, scaly, with persistent expanded petiolar bases of previous years. Stems 1 or 2, erect, somewhat striate, glabrous or rarely sparsely minutely hairy. Basal leaves compound, with 13–23 leaflets; petiole 1.5–6 cm long, 1–2× as long as leaf rachis, distinctly expanded into a triangular, winged, persistent base that becomes scalelike in subsequent seasons; rachis grooved, 0.7–3 cm long; leaflets petiolulate, ovate to ovate-oblong in outline, 2–11 mm long, 1–7 mm wide, pinnatifid, laciniate, to incised, the segments usually incised to dentate, margin sparsely ciliate with minute trichomes 0.06–0.12 mm long, apex acute, terminal segment as large as lateral ones; petiolule grooved, (0.5–)1–3 mm long. Cauline leaves 2–6, with 13–19 leaflets, similar in morphology to basal leaves, reduced in size and degree of leaflet division upward; petiole 0.7–1.2 cm long; rachis 2–4× as long as petiole; leaflets short petiolulate or subsessile in uppermost leaves. Inflorescences corymbose racemes, elongated considerably in fruit, lowermost few flowers bracteate; bract usually adnate to pedicel, lowermost pinnatifid to pinnatisect. Sepals oblong, 3–4 mm long, 1.2–1.5 mm wide, slightly saccate, erect or suberect, caducous after anthesis, glabrous, scarious at margin and apex. Petals white, broadly obovate to suborbicular, 8–11 mm long, 6–7 mm wide, abruptly narrowed into a clawlike base to 1 mm long, apex shallowly subemarginate to subtruncate and with a minute apicula. Stamens conspicuously tetradynamous, erect; filaments white, median pairs 4–5 mm long, lateral pair 3–3.5 mm long; anthers oblong, ca. 1 mm long. Nectar glands confluent, well developed into 2 median teeth and 4 lateral teeth, lateral teeth 1 on each side of a lateral stamen. Fruiting pedicels ascending, straight, glabrous, striate, lowermost 2–2.5 cm long, gradually shorter upward. Fruit linear, 2.5–5 cm long, ca. 2 mm wide, on a gynophore to 1 mm long; style 3–4 mm long; stigma discoid, slightly wider than style. Seeds brown, oblong, ca. 2.4 ×1.2 mm.

Distribution and habitat. In wet paramo, upper montane forests, scrubby subparamo, and heath and chaparral vegetation in Parque Nacional Podocarpus, Loja Province, at 3000–3450 m.

Cardamine lojanensis is readily distinguished from all of the tuberous South American species by its pinnately compound basal leaves with 6–11 pairs of petiolulate lateral leaflets. All of the other South American tuberous species of *Cardamine* (*C. garavaentae* O. E. Schulz, *C. hispidula* Philippi, *C. macrostachya* Philippi, *C. tuberosa* DC., *C. valdiviana* Philippi, *C. variabilis* Philippi, and *C. vulgaris* Philippi), which are distributed exclusively in Chile and Argentina, have simple, trifoliolate, or rarely pinnately compound basal leaves with 2–4 pairs of sessile lateral leaflets. Furthermore, the tuberous rhizomes in these species are not scaly and the bracts are not adnate to pedicels, whereas in *C. lojanensis* the rhizomes are scaly and the bracts

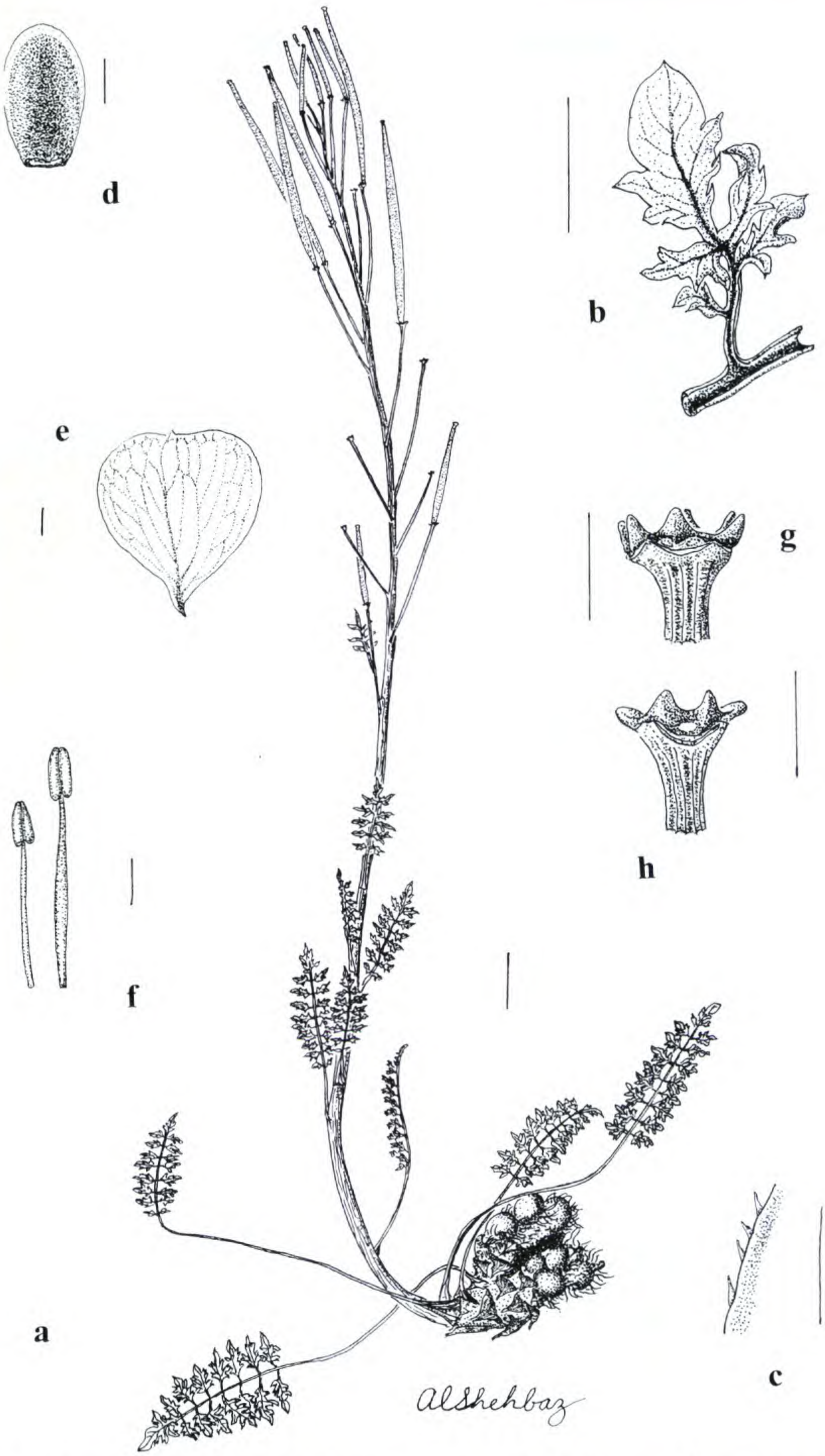

Figure 1. a–h. *Cardamine lojanensis* Al-Shehbaz. —a. Plant. —b. Leaflet. —c. Portion of leaflet margin. —d. Sepal. —e. Petal. —f. Median (long) and lateral stamens. —g. Median view of nectar glands. —h. Lateral view of nectar glands. Figures a–c from *Øllgaard et al. 58147*, d–h from *Øllgaard et al. 58037*. Scale bars: a = 1 cm, b = 5 mm, c = 0.5 mm, d–h = 1 mm.

are adnate to pedicels. These differences are rather significant, and the new species is apparently unrelated to any of the tuberous species listed above.

A critical examination of the other South American *Cardamine* shows that *C. lojanensis* is more closely related to some of the perennial Ecuadorian and Colombian members of the genus, especially those that have pinnately compound basal leaves with petiolulate leaflets, large flowers with petals 8–18 mm long, and bracteate lower portions of the inflorescence. It is most closely related to *C. picta* Hooker (Colombia, Ecuador), *C. jamesonii* Hooker (Ecuador), and *C. obliqua* A. Rich. *Cardamine obliqua*, which includes *C. johnstonii* Oliver and *C. rhizomata* Rollins, is a highly variable species (Jonsell, 1982) distributed in tropical Africa, southern Central America, and northern South America (Rollins, 1993). From these three species, *C. lojanensis* is readily distinguished by its tuberous scaly rhizomes, basal leaves with 6–11 pairs of lateral leaflets, and minute trichomes only 0.06–0.12 mm long. In contrast, *C. picta*, *C. jamesonii*, and *C. obliqua* have slender rhizomes that are neither tuberous nor scaly, basal leaves with up to 5 pairs of lateral leaflets, and leaves glabrous or with trichomes that are much longer.

The boundaries between several of the South American species of *Cardamine* are difficult to define, and the genus is badly in need of a critical revision. Schulz (1903) recognized in South America as many as 27 species with 28 additional infraspecific taxa, whereas Gilg and Muschler (1909) recognized 23 species with 32 additional infraspecific taxa. The opposite extreme was taken by Sjöstedt (1975), who reduced the 97 species described from Central and South America to only 5 and basically ignored the tremendous amount of diversity among the Latin American *Cardamine*. There are at least 30 well-defined species in South America (Al-Shehbaz, 1988), but most of the infraspecific taxa recognized by Schulz (1903) and Gilg and Muschler (1909) can be reduced to synonymy.

Paratypes. ECUADOR. **Loja** (all localities in Parque Nacional Podocarpus): Cerro Toledo, 3350 m, 79°7′W 4°23′S, *Madsen, Bloch & Christensen 75664* (AAU); Cerro Toledo, E of Yangana, 3300–3450 m, 79°6′W 4°24′S, *Øllgaard, Laegaard, Thomsen, Korning & Illum 58037* (AAU); Cerro Toledo, 79°20′W 4°23′S, 3000–3400 m, *Madsen, Bergman & Pedersen 86117* (AAU).

Acknowledgment. I thank Henk van der Werff for correcting the Latin description.

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Lesquerella vicina (Brassicaceae), a New Species from the Uncompahgre River Valley in Western Colorado

John L. Anderson
U.S. Bureau of Land Management, 2015 W. Deer Valley Rd., Phoenix, Arizona 85027, U.S.A.

James L. Reveal
Department of Plant Biology, University of Maryland, College Park, Maryland 20742-5815, U.S.A.

Reed C. Rollins
Gray Herbarium, Harvard University, 22 Divinity Avenue, Cambridge, Massachusetts 02138, U.S.A.

ABSTRACT. *Lesquerella vicina* (Brassicaceae) is proposed for a perennial with white flowers found near Montrose, Colorado. It is most closely related to the yellow-flowered *L. rectipes*, differing additionally by having broader basal leaves. In the Montrose area it grows on Mancos Shale from 6000 to 7200 feet at the ecotone between pinyon-juniper woodland and salt desert scrub. At the lower elevation the plants have a more ephemeral growth form, but at the higher elevations the plants are longer-lived perennials with well-developed caudices.

Lesquerella vicina Anderson, Reveal & Rollins, sp. nov. TYPE: U.S.A. Colorado: Montrose Co., on a small flat-topped mesa overlooking the Uncompahgre River just S of 66500 Kinikin Road about 4 air mi. SE of Montrose, on grayish white soil atop adobe Mancos Shale associated with *Artemisia, Yucca,* and *Opuntia* at about 6050 ft. elev. in sec. 10, T48N, R9W, 29 June 1995, *Reveal 7492* (holotype, GH; isotypes, BM, BRY, COLO, MARY, MO, NY, RM, TEX, UC, US). Figure 1.

A *L. rectipes* folius latioribus et floribus albus differt.

Plants first-year flowering perennials lacking a well-developed caudex, older plants with a well-developed caudex, densely pubescent, the foliage gray-green and scabrous; trichomes substipitate, the rays 3–6, slightly fused or less frequently distinct, forked or bifurcate, appressed to spreading; stems (of fruiting plants) 1–2.5 dm long, few to several, ascending (in flower) or nearly prostrate (in fruit), simple; basal leaves rosulate, 2–7 cm long, the blades ovate to rhomboid or rotund, (1)2–3.5 cm long, (1)1.5–2.5 cm wide, flat, entire or occasionally shallowly repand, narrowing abruptly to the 1–3(3.5)-cm-long petiole; cauline leaves (0.7)1–2.5 cm long, the blades narrowly elliptic to elliptic, 0.7–1.8 cm long, 0.4–0.8 cm wide, flat, entire, narrowing gradually to the 0.2–0.5(0.7)-cm-long petiole; inflorescences dense, the buds ellipsoid; sepals 4–6 mm long, elliptic, lavender under the grayish trichomes; petals 6–10 mm long, white, often tinged with lavender without, pale yellow at the base of each petal within, glabrous, the blade narrowly spathulate and not differentiated into a blade and claw; filaments slender, 4–5.5 mm long; stamens linear, 1.2–1.6 mm long; infructescence elongated; pedicels (0.4)0.6–1.2 cm long, stout, curved to slightly sigmoid but always ascending; siliques 0.5–0.7 cm long, subsessile, nearly globose to obovoid, the valves densely pubescent with spreading trichomes without, glabrous within; septum entire, smooth, glabrous, the funicles attached ⅓ or less of their length; styles 4–6 mm long, glabrous, slender, the stigmas expanded; ovules 4(6) per locule; seeds 2–2.2 mm long, ovate, flattened, orangish brown, faintly margined; cotyledons accumbent, about as long as the radicle.

Lesquerella vicina (from *vicinus,* neighboring, alluding to the type locality, near the home of Reveal's Montrose neighbors Stan Hersh and Hazel Pollard) is most likely a first-year flowering perennial. The spring of 1995 was particularly moist in the Montrose area, and the specimens collected in late June of 1995 flowered the first year of their duration. The plant has not been seen during pre-

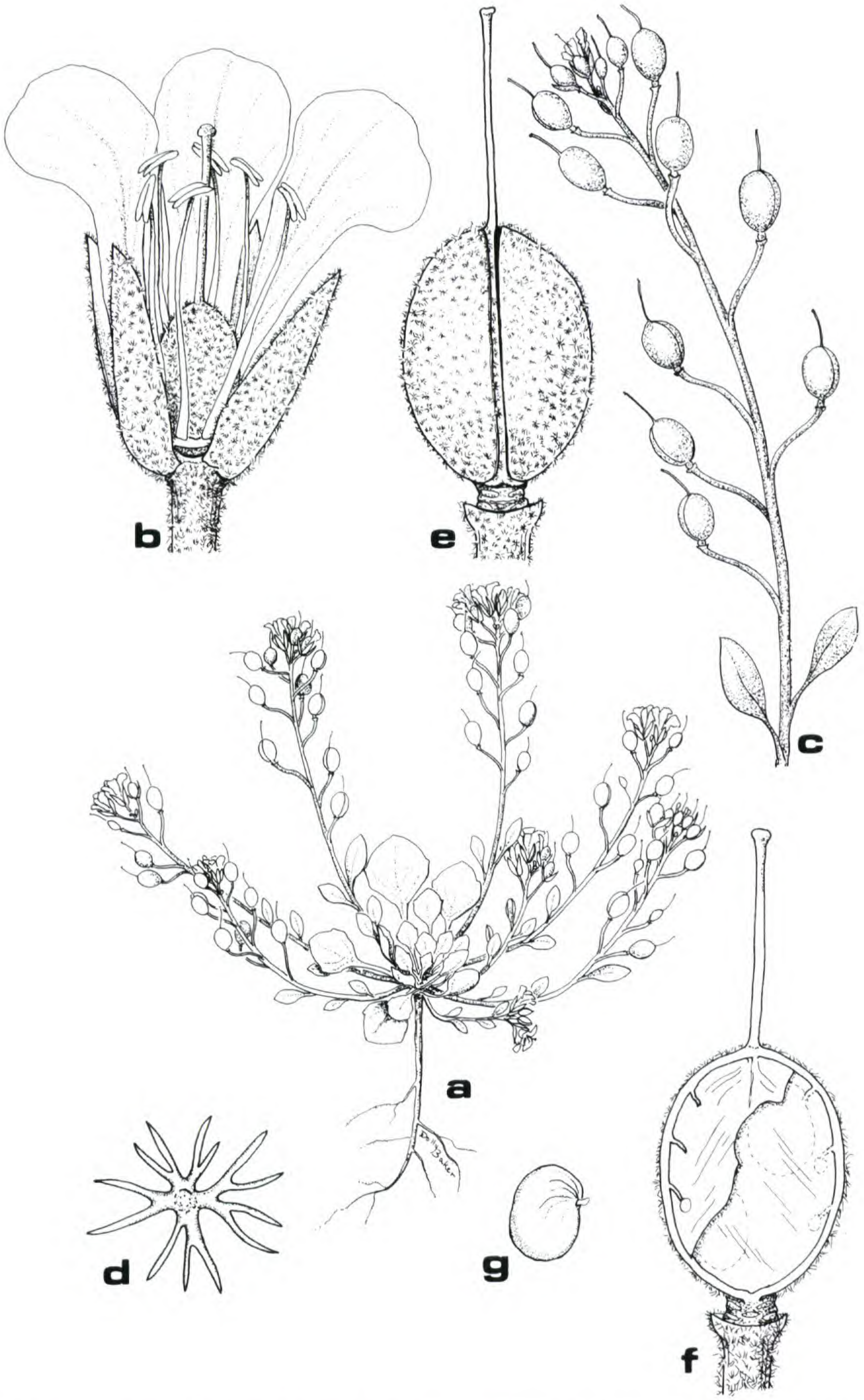

Figure 1. *Lesquerella vicina* Anderson, Reveal & Rollins. —a. General habit (×0.5). —b. Details of a flower (×10). —c. An inflorescence (×5). —d. A stellate hair (×50). —e, f. Two views of a silique (×20). —g. A seed (×20).

vious visits to the type location and it is suggested that unless the area is subjected to two or more years of favorable conditions, individual plants of *L. vicina* at low elevations will only live a single growing season. Fully mature fruits with seeds were produced in 1995. This may be one of those species that maintains a seed bank but appears only when favorable conditions occur. However, specimens

from the Billie Creek area (*Anderson 87-61, 88-15b,* and *88-18*), which grow a thousand feet higher in elevation than those at the type locality, have well-developed caudices and appear to be short-lived perennials. Perhaps, increased precipitation at the higher elevation locality allows these plants to live longer and develop a perennial growth form. At the lower elevations, the drier conditions result in a more ephemeral life cycle.

The upper Uncompahgre River Valley between Ridgeway and Montrose forms a narrow cul-de-sac of desert badlands (adobes) and pinyon-juniper woodlands on Mancos Shale surrounded on three sides by montane forests of the San Juan Mountains and the Uncompahgre Plateau. The Uncompahgre River flows northward out of this narrow valley to its confluence with the Gunnison River at Delta, Colorado. These isolated badlands around Montrose were already known to contain a number of local endemics, including *Lomatium concinnum* (Osterhout) Mathias and *Penstemon retrorsus* Payson ex Pennell. On a search for *Lomatium concinnum*, Anderson found an undescribed *Lesquerella* approximately 15 miles south of Montrose in 1987. Reveal independently discovered this same entity about 4 miles south of Montrose at the subsequent type locality in 1995. The earliest collection of *L. vicina*, although it was unrecognized as representing an undescribed species, was made by Payson (*669*) in 1915. The Payson collection, in fruit only, was first identified as *L. prostrata* A. Nelson, a local species of southwestern Wyoming and adjacent Utah. Later Payson annotated the specimen in GH as *L. rectipes.* Another specimen of *L. vicina* had been collected previously by Welsh et al. (*22765*) southwest of Montrose on a powerline survey for rare plants. Welsh (pers. comm.) thought this specimen, where white flowers were noted, might represent a new species; but, it was unidentified until Rollins placed it in *L. rectipes* with a question mark and a notation that white flowers were unknown in that species. Welsh and Anderson revisited this locality in 1990. (Despite label inconsistencies, *Welsh et al. 22765, Welsh & Anderson 24435,* and *Anderson & Welsh 90-46* are from the same locality.) An earlier study (Rollins & Shaw, 1973) did include the Payson specimen, which was sufficiently different from *L. rectipes* to provoke an interest in looking for the plant in the vicinity of Montrose. No population of *L. vicina* was found there in 1981 although three collections (*Rollins & Rollins 8129, 8133, 8136,* GH) of *L. rectipes* were made to the southwest of that area.

The combination of broad, basal leaves that abruptly narrow to the petiole, globose to obovoid siliques with four (rarely six) ovules per locule, forked or bifurcate 3–6-rayed trichomes, an erect to prostrate habit, and an entire septum all associate *Lesquerella vicina* with *L. rectipes,* a species in which many populations lack a well-developed caudex. *Lesquerella rectipes* ranges from southwestern Colorado and eastern and south-central Utah southward to northern Arizona and northwestern New Mexico. Rollins (1993) noted that the taxon is exceedingly variable, but did not recognize the combinations of features considered here as representing *L. vicina.* The new species may be readily distinguished from *L. rectipes* by its broader basal leaves (1–2.5 cm vs. 0.3–1.2 cm), longer petioles, lavender sepals, white petals with pale yellow bases that are not differentiated into a blade and claw and that become lavender with age, densely (rather than sparsely) pubescent siliques, glabrous styles, and a slightly margined, orangish brown seed. The most distinctive character for *L. vicina* is the white petals. This feature alone will distinguish the species from all others in the Intermountain and Rocky Mountain West.

The range of *Lesquerella vicina* is currently known to extend for 20 miles, from Billie Creek 15 miles south of Montrose to Bostwick Park 5 miles north of Montrose. Within this range there are four different localities; from south to north they are Billie Creek, the type locality, the Montrose-Nucla Road site, and Bostwick Park. Its edaphic habitat is usually Mancos Shale, often with sandstone fragments, from 6000 to 7200 feet, where it occurs at the ecotone between pinyon-juniper woodland and salt desert scrub. At the type locality, *Lesquerella vicina* occurs with mixed desert shrub (*Artemisia, Chrysothamnus, Tetradymia, Opuntia,* and *Yucca*) but does not seem to extend lower in elevation to the adobe badlands and salt desert scrub.

Paratypes. U.S.A. **Colorado:** Montrose County, dry stony slopes of hills E of Montrose, 6000 ft., 15 June 1915, *Payson 669* (GH); pinyon-juniper community, sandy substrate and sandstone outcrops, "ca. 7.5 mi. SW of Montrose, T18N, R10W, sec. 18" [township incorrect], ca. 6800 ft., 15 May 1984, *Welsh et al. 22765* (BRY, GH); ca. 6.5 W of Oak Grove on Hwy. 90 (Montrose-Nucla Rd.), 0.25 mi. beyond switchbacks, on mesa top of Dakota sandstone with pinyon-juniper woodland, 6720 ft., T48N, R10W, sec. 8 SESESW, 16 May 1990, *Anderson & Welsh 90-46* (COLO, GH); pinyon-juniper community on Dakota Sandstone, "9.5 mi SW of Montrose, T49N, R85W, sec. 2" [range and township incorrect], ca. 6720 ft., 16 May 1990, *Welsh & Anderson 24435* (BRY); N end of Bostwick Park, at head of draw with road leading to Montrose, Mancos Shale hillside with sandstone fragments, growing in open pinyon-juniper woodland with *Artemisia tridentata* Nutt., 6800 ft., T49N, R8W, sec. 33 SESW, 21 May 1990, *J. Anderson 90-69* (COLO); ca. 4 mi. S of Montrose and 2 mi. E of Hwy. 550, Mancos Shale hill with water tank

above W side of South Canal, growing on hilltop with scattered pinyon-juniper with *Atriplex confertifolia* (Torr. & Frém.) S. Wats., *Artemisia spinescens* DC., and *Yucca*, 6240 ft., T48N, R9W, sec. 24 NENW, 22 May 1991, *J. Anderson 91-31* (GH); Ouray County, Billie Creek State Wildlife Area, ca. 1.5 mi. E of U.S. Hwy. 550, access from Hwy. 550 is 1.7 mi. E. on Billie Creek Rd. and then 1.6 mi. S on Chaffee Gulch Rd., Mancos Shale hill along Chaffee Gulch, growing under scattered pinyon-juniper with *Peraphyllum ramosissimum* Nutt., *Amelanchier alnifolia* (Nutt.) Nutt., *Cercocarpus montanus* Raf., *Yucca*, *Artemisia tridentata*, and *Lomatium concinnum* (Osterh.) Mathias, 7000 ft., T46N, R8W, sec. 3 NWSE, 1 June 1987, *J. Anderson & J. Ferguson 87-56*, 5 June 1987, *J. Anderson & J. Ferguson 87-61* (GH), 9 May 1988, *J. Anderson 88-15a* (ASU) and *88-15b* (ASU); near Billie Creek Wildlife Area, ca. 0.5 mi. E of U.S. Hwy. 550, S-facing slope of ridge between Billie Creek and Chaffee Gulch, Mancos Shale with sandstone fragments on the surface, growing in open understory of pinyon-juniper woodland with *Amelanchier alnifolia*, *Peraphyllum ramosissimum*, *Cercocarpus montanus*, and *Yucca*, 7200 ft., T46N, R8W, sec. 4 NWNE, 10 May 1988, *J. Anderson 88-18* (COLO); Billie Creek Wildlife Area, 0.5 mi. E of Hwy. 550 along Billie Creek Rd., S-facing slope of interbedded shale and sandstone with *Atriplex canescens* (Pursh) Nutt., *Hymenoxys acaulis* (Pursh) K.F. Parker, *Opuntia*, and *Lesquerella rectipes* Woot. & Standl., 6550 ft., T47N, R8W, sec. 33 NWNW, 10 May 1988, *Anderson 88-21* (GH).

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A New Name for an Endemic Ecuadorian Violet

Harvey E. Ballard, Jr.
University of Wisconsin-Madison, Herbarium, Department of Botany, 132 Birge, 430 Lincoln Drive, Madison, Wisconsin 53706, U.S.A.

Peter M. Jørgensen
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. Typification studies have revealed that the name *Viola parvifolia* Bentham, until now applied to an endemic high-elevation violet of Ecuador, is a homonym of *V. parvifolia* Roemer & Schultes, which is a synonym of *Ionidium glutinosum* Ventenat and, ultimately, of *Hybanthus parviflorus* (Mutis ex L.f.) Baillon. A new name, *V. polycephala* H. E. Ballard & P. Jørgensen, is proposed.

During nomenclatural studies of Violaceae for the checklist for the "Catalogue of Vascular Plants of Ecuador," we discovered that the name *Viola parvifolia* has been used twice. Roemer and Schultes (1819) first applied it as a new name for Willdenow's *V. microphylla*, a nomen nudum (this name was later validly published for a different species). Roemer and Schultes's name refers to a specimen of *Ionidium glutinosum* Ventenat, which is now treated as a synonym of *Hybanthus parviflorus* (Mutis ex L.f.) Baillon. Bentham (1845) used the name a second time for a high-elevation violet of section *Andinium* endemic to Ecuador. Our examinations of type material for most of the approximately 200 published names of South American *Viola* and of protologues for the remaining names have revealed no evidence of another available name for Bentham's violet. While it resembles certain violets of the Andes considerably further south, it is morphologically distinctive in its perennial habit; stout erect woody rhizome ramifying underground to produce multiple crowns; numerous, mostly glabrous, small and densely packed rhombic- to deltoid-lanceolate leaf blades, weakly decurrent petioles and margins weakly crenulate nearest the acute apex; and small flowers with very short spurs. We propose the following name, referring to the multiple, rounded crowns.

Viola polycephala H. E. Ballard & P. Jørgensen, nom. nov. Replaced name: *Viola parvifolia* Bentham, Pl. Hart. 161. 1845, not *V. parvifolia* Willdenow ex Roemer & Schultes, Syst. Veg. 5: 391. 1819. PROTOLOGUE. Ecuador: Napo: "In locis sabulosis montis Antisana altit. 15,400 ped.," *Hartweg 892* (holotype, K; isotypes, BM, G, K; photos, F(G)-024040, WIS(G)).

Identification and Typification of *Ternstroemia lineata* de Candolle (Theaceae)

Bruce Bartholomew
Department of Botany, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118–4599, U.S.A.

Rogers McVaugh
Department of Biology, CB# 3280, Coker Hall, The University of North Carolina at Chapel Hill, Chapel Hill, North Carolina 27599–3280, U.S.A.

ABSTRACT. The lone high-elevation species of *Ternstroemia* that occurs in central Mexico has gone for many years under the name *Ternstroemia pringlei* (Rose) Standley. The much older name *Ternstroemia lineata* de Candolle, based on a painting of a plant from the same general area, has mostly been overlooked or considered to be unidentifiable. This article provides typification for the relevant taxa, synonymy, and documentation for the identity of *T. lineata*.

I. TYPIFICATION

Ternstroemia lineata de Candolle, Mém. Soc. Phys. Hist. Nat. Genève 1: 409, *pl. 1.* 1823 ["1822"]; [reprint, de Candolle, Mém. Ternst. 17, *pl. 1.* 1823].

KEY TO THE SUBSPECIES OF *TERNSTROEMIA LINEATA*

1a. Main lateral leaf veins not impressed on the adaxial surface . . . . . *T. lineata* subsp. *lineata*
1b. Main lateral leaf veins impressed on the adaxial surface . . . . . *T. lineata* subsp. *chalicophila*

Ternstroemia lineata subsp. **lineata.** *Ternstroemia lineata* DC., as to type. TYPE: Mexico. Morelos or México: "ad clivum vulgo del Toto in itinere Sanctuarii Chalmensis," *M. Sessé & J. M. Moçiño Ic. Fl. Mex. 233,* the holotype, a painting in the Torner Collection of Sessé and Moçiño Biological Illustrations (Hunt Institute of Botanical Documentation, accession number 6331.1617).

Ternstroemia cuneifolia Sessé & Moçiño, Fl. Mex. ed. 2, 128. 1894, non Gardner (1845). TYPE: Mexico. Morelos or México: "In anfractibus de el Toto haud procul a Quauhnahuaca [Cuernavaca]," Herb. Sessé & Moç. 2330 (the lectotype, here designated, MA (the specimen from which F negative 48444 was taken); isolectotypes, MA, 2 sheets; F, P).

Taonabo pringlei Rose, Contr. U.S. Natl. Herb. 8: 322. 1905. *Ternstroemia pringlei* (Rose) Standley, Field Mus. Nat. Hist., Bot. Ser. 4: 234. 1929. TYPE: Mexico. Morelos: Sierra de Tepoxtlán, 2300 m, 18 Mar. 1899, *C. G. Pringle 8013* (holotype, US; isotypes, A, AC, BM, C, CAS, CM, F, G, GH, K, MEXU, MICH, MO, MSC, NY, PH, POM, S, UC, VT).

Distribution. Mexico (Guerrero, Jalisco, México, Michoacán, Morelos, Oaxaca, Sinaloa).

Ternstroemia lineata subsp. **chalicophila** (Loesener) B. Bartholomew, Phytologia 64: 458. 1988. *Ternstroemia chalicophila* Loesener, Bull. Herb. Boissier sér. 2, 3: 213. 1903. TYPE: Mexico. Chiapas: "in clivo calcareo supra Huitztan," 10 Mar. 1896, *C. & E. Seler 2276* (holotype, B (destroyed); lectotype, designated by Bartholomew (1988), GH).

Distribution. Mexico (Chiapas, Oaxaca), Honduras.

II. IDENTIFICATION OF THE SPECIES *TERNSTROEMIA LINEATA*

A. P. de Candolle (1823) described *Ternstroemia lineata* after study of paintings made by the artists of the Royal Botanical Expedition to New Spain (the "Sessé & Moçiño expedition"), probably in 1789. For a description of the expedition and its aims, its travels, collections, paintings, and botanical accomplishments in general, see especially articles by McVaugh (1977, 1980, 1987, 1990). Suffice it to say here that the paintings made by the artists of the expedition, some 2000 in number, were carried by José Mariano Moçiño, the surviving botanist of the expedition, when he fled from Spain to France in 1812. These were the paintings that had been prepared to accompany a grand new *Flora Mexicana*, which never came to fruition. Moçiño brought the paintings to the attention of the botanist A. P. de Candolle, who studied them first when he lived at Montpellier, France, and later at Geneva,

to which he moved in 1816. De Candolle recognized that many species and genera new to science were represented among the paintings. He and his most favored contemporaries, between 1813 and 1850, proposed approximately 370 new specific names based wholly or in large part on the paintings. It was his practice to write his determination on each painting, usually but not always the name that was eventually published. If the Expedition's artists made more than one copy of any individual painting, as they often did, de Candolle customarily annotated each one.

When Moçiño left Geneva in 1817 to return to Spain, planning to take the paintings with him, he presented to de Candolle all the "duplicates," to the number of about 309. De Candolle at once arranged to have copies hastily made in Geneva, of all the rest except about 200, these latter representing what he considered to be well-known species. More than 100 artists took part in this work. Moçiño reached Barcelona, where he died in 1820, and the paintings were lost to science until 1979, when they were discovered in a private library and acquired by the Hunt Institute in Pittsburgh, Pennsylvania, where they now constitute the Torner Collection of Sessé and Moçiño Biological Illustrations [about a tenth of them are devoted to zoological subjects]. De Candolle's copies, in the meantime, remained at Geneva in the library of the Conservatoire Botanique and have continued to be the subjects of much study.

After the original paintings had been lost for a century or so, most botanists took it for granted that the examples in the de Candolle collection (whether later copies, or duplicate originals by the original artists) had to be treated as the types, or even holotypes, of Candollean species that were based solely on these illustrations without reference to additional specimens. With the Torner collection available and essentially complete, the perspective has changed somewhat. The reasoning is about as follows: All the paintings in the Torner Collection are those made by the original artists while the Expedition was in America. When there is an example in the Torner Collection of some particular painting and no copy at all in Geneva, as in the case of *Ternstroemia lineata*, the Torner example must be the holotype. When there is a Torner example and also an "original" copy at Geneva, the Torner example cannot ordinarily be a holotype but can be a lectotype, because de Candolle's annotations usually show that he saw and presumably studied both. Often the Torner example proves to be more complete or more representative, thus making it a preferable choice for lectotypification. If the copy at Geneva is not an "original," but one of those commissioned by de Candolle in 1817, the Torner copy is usually the better choice for lectotypification unless there are extenuating circumstances. Sometimes it may be argued that in this situation the Torner example is a holotype because de Candolle probably studied it and made up his mind (and his description) before the later copy existed.

In the particular case under consideration, the argument seems straightforward. De Candolle had access to, and annotated as *Ternstroemia lineata*, two original paintings now in the Torner Collection. Each bears a contemporary annotation, "233" in Moçiño's hand (in McVaugh's opinion), the number designating its position in the *Icones Florae Mexicanae*, which was a selected group of about 460 paintings that were numbered in this way in 1791 or before (McVaugh, 1980). One of the paintings, no. 6331.1617, is a more complete drawing than the other, no. 6331.0003, which lacks details of the fruit and has a different rendering of the bark texture. No. 6331.1617 was copied directly for publication as Plate 1 of de Candolle's *Mémoire* (1823), where it served as the illustration of *Ternstroemia lineata*. The other painting, no. 6331.0003, bears the contemporary name *Ternstroemia meridionalis*, and thus was doubtless the basis for de Candolle's citation "*Ternstroemia meridionalis* Moç. et Sessé fl. mex. ined. ic. et descr." (de Candolle, 1823). It seems clear that no. 6331.1617, having been de Candolle's primary basis for the new name, is to be treated as the holotype of the name *Ternstroemia lineata*. Painting no. 6331.0003 does not have any type status in that the code does not have a provision for this situation.

Identification of the plant illustrated in the holotype is a little less straightforward. Although no scale is indicated on the drawing, the leaf shape, the attenuated leaf base, and the size of the pedicels and flowers in relation to the leaf size, all agree with the plant that has been called *Ternstroemia pringlei*, that is to say with the only species of the genus known from the type-region of both *T. pringlei* and *T. lineata*. Students who have worked subsequently with the group have questioned the identity with *T. pringlei*, but have failed to make any other disposition (Kobuski, 1942), because the original illustration in the protologue shows two features that are not known in any other species of *Ternstroemia*, viz. a distinct transverse line across the petals, and the absence of any bracteole scars or bracteoles below the sepals. De Candolle himself, working from the original colored drawings, noted these features: "Corolla subglobosa albida

cum linea rubra transversali in medio loborum picta," and "Bracteolae nullae aut deciduae."

Both these questionable features can be explained away: first the absence of bracteoles. Reference to the synonymy given above shows clearly that *Ternstroemia lineata* and *Ternstroemia cuneifolia* Sessé & Moçiño are based on the same collections, taken by Sessé and Moçiño at the same time, the only difference being that *T. lineata* was based not on specimens but on a colored painting made from them. It is only necessary to examine the original detailed description of *T. cuneifolia* to establish the fact that the want of bracteoles or their scars on the drawing was the fault of the artist, not a feature of the plant. In the protologue of *T. cuneifolia* the description reads, "Bracteolae duae, oppositae, in apice pedunculorum, membranaceae, obtusae, deciduae." Because the bracteoles of *Ternstroemia* are in fact deciduous, the artist who made the paintings very probably did not see them. The scars are ordinarily conspicuous after the bracteoles fall, and their omission must be attributed to an oversight on the part of the artist.

The red line across the petals, which shows only in such petals as have been fully colored by the artists, is apparent in both the paintings in the Torner Collection, and shows as a black line in the black-and-white plate published by de Candolle. The line corresponds approximately to where the ends of the sepals would have pressed against the petals in the bud. All the calyces in both paintings are shown as reflexed, as was noted by de Candolle. In the living condition the sepals are reflexed only after the capsule is mature and begins to dry. It is evident that the artist was illustrating a plant whose flowers had at least started to dry. The lines may have been caused by pressure of the sepals against the petals in pressed botanical specimens, or by earlier pressure against the petals in the young flowers. The artists were always under a certain constraint of time, as they were traveling with a moving expedition under primitive field conditions, and doubtless were often obliged (especially where more than one species was to be illustrated during a stay of limited duration) to work with detached specimens that were no longer fresh. Among the paintings of other plant species in the Torner Collection, some of the "duplicate" paintings in fact include a fresh specimen and another with partially wilted leaves. We regard the red lines on the petals as artifacts, not as natural features of the plants.

In conclusion, we think there can be no doubt that *Ternstroemia lineata* and *Ternstroemia pringlei* are one and the same species, and that the earlier name must be reinstated.

Acknowledgment. We thank the Hunt Institute for Botanical Documentation as well as the curators and staffs of the following herbaria for the courtesy of making loans for study by Bartholomew, and/or making specimens available during his visits: A, AC, BM, C, CM, CAS, F, G, GH, K, MA, MEXU, MICH, MO, NY, P, PH, POM, S, UC, US, VT.

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Especies Nuevas de Piperaceae de los Andes al Sur de Colombia

Ricardo Callejas

Departamento de Biología, Facultad de Ciencias Exactas y Naturales, Universidad de Antioquia, Apartado 1226, Medellín, Colombia

Julio Betancur

Instituto de Ciencias Naturales, Universidad Nacional de Colombia, Apartado 7495, Santafé de Bogotá D.C., Colombia

RESUMEN. Se presenta la descripción e ilustración de tres especies nuevas de la familia Piperaceae, *Peperomia alwynii*, *Piper curvinervium* y *Piper dolichostylum*, las cuales crecen hacia el sur de la región andina colombiana; así mismo se discuten para cada especie sus relaciones de parentesco, distribución geográfica, ecología y hábitat.

ABSTRACT. Three new species of Piperaceae, *Peperomia alwynii*, *Piper curvinervium*, and *Piper dolichostylum*, from the southern Andes region of Colombia, are described and illustrated, and their relationships, geographical distribution, habitat, and ecology are discussed.

La porción norte de los Andes posee, tal vez, la mayor diversidad de plantas en el neotrópico y debido a la alta tasa de deforestación a la que ha sido sometida en los últimos años, es un área prioritaria para el estudio y la conservación (Henderson et al., 1991). Dentro de esta región, las vertientes andinas (piedemonte pacífico y oriental de la cordillera montañosa), principalmente entre los 500 y 2200 m alt., a ambos lados de la cordillera, son probablemente los sitios más ricos en especies y los menos explorados (Hernández-Camacho et al., 1992). En estas vertientes, algunos grupos de plantas, como la familia Piperaceae, poseen una alta concentración de especies, presentando un fenómeno de "radiación explosiva" (Gentry, 1982a, b).

Las tres especies de Piperaceae que aquí se describen hacen parte de un proyecto de investigación que se desarrolla actualmente, con el fin de analizar la diversidad floristica en las vertientes amazónica y pacífica del Nudo de los Pastos, al sur de Colombia, el cual ha arrojado interesantes datos, registros y novedades taxonómicas (Franco et al., 1995). El nudo de los Pastos es un macizo montañoso, del cual se originan hacia el norte las tres cadenas de montañas que forman los Andes en Colombia. Esta zona es especialmente diversa floristicamente y presenta un gran número de especies endémicas (Gentry & Dodson, 1987).

Peperomia alwynii Callejas & Betancur, sp. nov. TIPO: Colombia. Nariño: municipio de Barbacoas, corregimiento Altaquer, vereda El Barro, Reserva Natural Río Ñambí, margen derecha del río Ñambí, 1325 m alt., 1°18′N–78°08′W, vertiente occidental andina, bosque pluvial premontano, primario, poco intervenido, 7 dic. 1993 (fl), *P. Franco, D. Giraldo, W. Beltrán, A. Prieto & O. Rivera 4999* (holótipo, COL; isótipo, HUA). Figura 1.

Haec species *Peperomiae hernandiifoliae* (Vahl) A. Dietrich affinis sed ab ea lamina glabra eciliata, glandulari, baccis conico-cylindricis, distantibus, maturitate apice scutulo minore, obliquo, concavo, recurvato differt.

Hierba carnosa, terrestre, ocasionalmente epífita y escandente, laxamente ramificada, nudos basales con numerosas raices adventicias, entrenudos 2.5–7 cm de long., 3–6 mm de diám., verdes, lustrosos, opacos cuando secos, glabros, eglandulares. Hojas alternas y peltadas; pecíolo 5–7.2 cm de long, 2–3 mm de diám., profundamente vaginado hacia la base, glabro, inserto (0.8)1.5–2.3 cm por encima del extremo basal de la lámina, verde o rojizo y opaco cuando seco; lámina (8.3)10–15(17) × 5–7.8(10) cm, ampliamente ovada, corto-a largo-acuminada, ocasionalmente caudada, acumen 1.5 cm de long., base redondeada a subtruncada, suculenta, opaca y membranácea cuando seca, verde nítida en la haz y verde pálida en el envés, glabra, glandular punteada, eciliada, palmatinervada, 4–5 pares de venas basales que divergen en ángulos de cerca de 90°, no ramificadas, la vena medial hacia la porción media o el tercio distal tiene 1–2 pares de nervios secundarios que divergen en angulos de 45°, impresas a levemente prominentes en la haz, prominentes en el envés, venación terciaria inconspicua. Inflorescencias terminales o axilares, solitarias o geminadas, ocasionalmente 3 con un eje

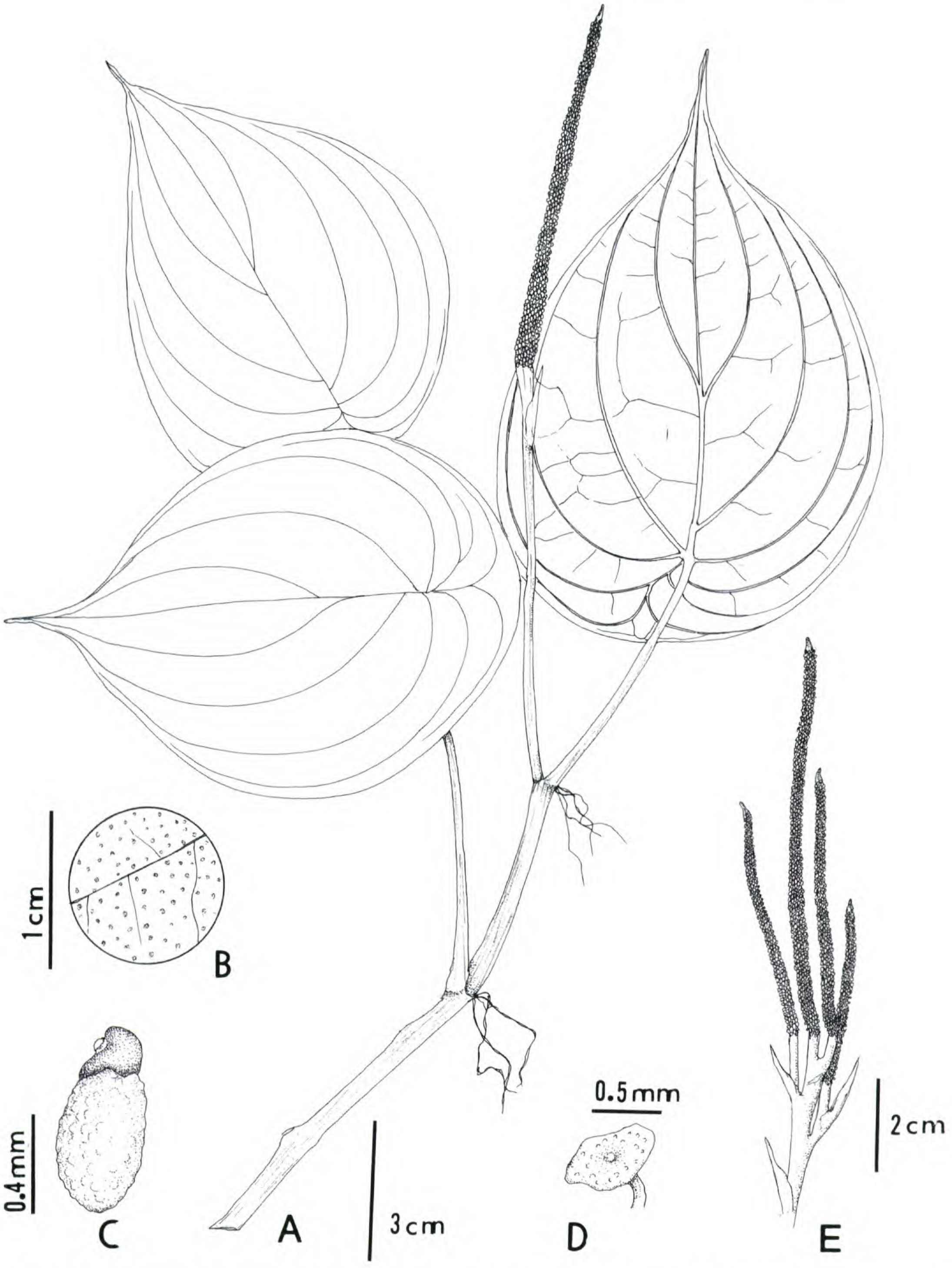

Figura 1. *Peperomia alwynii* Callejas & Betancur. —A. Hábito. -—B. Envés de la hoja indicando presencia de glándulas. —C. Fruto. —D. Bráctea floral. —E. Eje con inflorescencias solitarias y geminadas. A–D de *Gentry et al. 35191* (MO). E de *Gentry & Rentería 24539* (MO).

común de 1–2.8 cm de long., glabro; pedúnculo de la espiga 1–4 cm de long., 2 mm de diám., bracteolado, con 1–3 brácteas persistentes, 0.5–1.5 cm de long., ovadas, agudas, glabras, eglandulares; espigas erectas en todos los estadíos, rojizas en la antesis, verde pálido o crema en fruto, 5–8 cm de long., 0.5 mm de diám. en flor y 2 mm en fruto; flores densamente agrupadas en la antésis, distantes en fruto; brácteas florales 0.7–0.8 mm de diám., orbiculares, peltadas, glabras, eglandulares, cartáceas cuando secas; filamento 0.3–0.4 mm de long., anteras 0.2 mm de long., pistilo naciendo sobre la superficie del raquis, sésil en sus primeros estadíos, eventualmente distante y sobre un pseudopedicelo 0.1 mm de long., estilo en su porción anterior formando un pico corto por encima del estigma; cuerpo del fruto 0.8–1.1 mm de long., 0.5 mm de diám., cilíndrico-ovoide, marrón, verrucoso y víscido, rostrado, con un pico oblicuo y muy corto, curvado, estigma subapical.

Etimología. El nombre de esta especie honra la memoria de Alwyn H. Gentry, reconocido especialista de la familia Bignoniaceae y uno de los exploradores recientes del neotrópico más notables. A. H. Gentry siempre tuvo un especial interés por estudiar y elucidar las causas que generan la alta diversidad neotropical y la de algunos grupos de plantas, entre ellos las piperáceas, de las cuales fué un ávido colector.

Distribución y hábitat. Peperomia alwynii está ampliamente distribuida a lo largo de la vertiente occidental de la cordillera Occidental, en los Deptos. de Antioquia, Chocó y Nariño, a 1300–1750 m alt. Los bosques donde crece pueden catalogarse dentro de la zona de vida del bosque pluvial premontano (Espinal, 1990). La especie es frecuente y relativamente abundante en el interior de bosques poco perturbados, donde florece y fructifica muy posiblemente a lo largo de todo el año.

Otras especies del género *Peperomia* que se presentan con frecuencia en el área donde crece *P. alwynii,* son: *P. alata* Ruiz & Pavon, *P. choroniana* C. DC., *P. distachya* (L.) A. Dietrich, *P. hernandiaefolia* (Vahl) A. Dietrich, *P. heterophylla* Miquel, *P. jamesoniana* C. DC., *P. lancifolia* Hooker, *P. pilicaulis* C. DC., *P. striata* Ruiz & Pavon, *P. tenuimarginata* Trelease & Yuncker y *P. venosa* Yuncker.

El bosque de la Reserva Natural del Río Ñambí, de donde se tienen mayores registros para la especie, está dominado por especies de las familias Araceae, Rubiaceae y Melastomataceae, teniendo en cuenta la riqueza de especies y el valor de importancia (Franco et al., 1995); los géneros más diversos son *Anthurium* (Araceae), *Piper* (Piperaceae) y *Psychotria* (Rubiaceae). De acuerdo a la importancia ecológica, las especies con mayor índice de valor de importancia en el bosque son *Diplazium* sp. (Dryopteridaceae), *Elaeagia utilis* Weddell (Rubiaceae), *Miconia* sp. (Melastomataceae), *Ossaea macrophylla* (Bentham) Cogniaux (Melastomataceae), *Philodendron megalophyllum* Schott (Araceae), *Psychotria* sp. (Rubiaceae), *Welfia regia* H. Wendland ex André (Araceae) y *Wettinia castaneae* H. E. Moore & J. Dransfield (Araceae) (Franco et al., 1995).

Relaciones taxonómicas. Peperomia alwynii se reconoce por sus hojas alternas, peltadas, glabras, glandulares, márgenes sin cilios, carnosas, ovadas a orbiculares, discoloras y nítidas en la haz, pedicelos y pedúnculos rojos, inflorescencias con pedúnculos 1–3 bracteados, y particularmente por sus frutos cilíndricos, corto rostrados, con un pico grueso, curvado y estigma subapical.

La especie más cercana a *Peperomia alwynii* es *P. hernandiaefolia,* la cual a diferencia de la primera, tiene hojas densamente ciliadas y a menudo pubescentes sobre ambas superficies, eglandulares más gruesas, carnosas al secarse (vs. membranáceas en *P. alwynii*) y especialmente frutos globosos, largo-rostrados, con un pico delgado y tan largo como el cuerpo del fruto.

Los frutos cilíndricos y rostrados sugieren la posible inclusión de esta especie dentro del subgénero *Ryncophorum* (sensu Dahlstedt, 1900), donde muchas especies exhiben similitud respecto al hábito, la morfología foliar y la estructura de las inflorescencias. Hay en este subgénero un complejo de cerca 15 especies, entre las que se incluye *P. choroniana* C. DC., *P. hernandiaefolia* (Vahl) A. Dietrich, *P. induta* C. DC., y *P. stelechophila* C. DC. La inclusión de *P. alwynii* dentro del subgénero *Rynchophorum* es tentativa como consecuencia de que el esquema de clasificación subgenérica propuesto para *Peperomía* por Dahlstedt (1900) y revisado por Trelease y Yuncker (1950) y Yuncker (1974), no ha sido aún sujeto a un análisis cladístico riguroso.

Parátipos. COLOMBIA. **Antioquia:** municipio de Urrao, camino Encarnación to Parque Nacional de las Orquideas, vertiente occidental, Cordillera Occidental, 1600–1800 m, 27 ene. 1979 (fl, fr), *A. Gentry & E. Rentería 24539* (HUA, MO). **Chocó:** Cerro Torrá, vertiente nordeste, bosque de neblina, 1850–1930 m, 13 ago. 1982 (fl, fr), *F. A. Silverstone-Sopkin 1328* (CUVC, MO). **Nariño:** municipio de Barbacoas, corregimiento Altaquer, vereda El Barro, Reserva Natural Río Ñambí, márgen izquiera del río Ñambí, 1325 m alt., 1°18′N–78°8′W, 11 dic. 1993 (fl), *J. Betancur et al. 4854* (COL); 3–10 dic. 1993 (fl, fr), *P. Franco et al. 4796* (COL), *4904* (COL), *5134* (COL); municipio de Ricaurte, Reserva Natural La Planada, finca Salazar, 7 km después de Ricaurte, 1750

m alt., 1°08′N–77°58′W, 29 nov. 1981 (fl), *A. Gentry et al. 35191* (COL, MO).

Piper dolichostylum Callejas & Betancur, sp. nov. TIPO: Colombia. Putumayo: municipio de Mocoa, corregimiento San Antonio, vereda Alto Campucana, finca La Mariposa, vertiente amazónica de Colombia, 1350–1420 m alt., 1°12′N–76°38′W, 20 abr.–1 mayo 1994 (fr), *J. L. Fernández, A. Camero, Z. Marin y E. Mesa 11009* (holótipo, COL; isótipo, HUA). Figura 2.

Suffrutex 1.4–2 m altus, pauciramosus caule et ramulis gracilibus, parce breviter pilosis. Folia brevi-petiolata, petiolo 0.9–3 cm longo, dense breviter piloso; lamina 9.5–12.2 cm longa, 4.5–6.1 cm lata, supra secus nervos pilosa. Inflorescentia 2.2–3.5(5) cm longa; pedunculo filiformi 1.8–4.0 cm longo. Flos staminibus 4. Bacca ovata, diametro 0.5–0.9 mm, in stylum 1.2–1.4 mm longum desinens.

Subarbusto de 1.4–2 m de altura, laxamente ramificado, tallo principal y ramas delgadas, 0.5–2 mm de diám., entrenudos 2.2–3.5(5) cm de long., lisos, eglandulares, corto-pilosos, glabrescentes, indumento formado por tricomas uniseriados de 2–3 células, blancos; ápice caulinar emergiendo del interior del profilo y libre de la base foliar en los nudos floriferos. Hojas corto-pecioladas, pecíolos 0.9–3 cm de long., 0.6–1.1 mm de diám., vaginados basalmente, eglandulares, densamente corto-pilosos; lámina (9.5)11–12.2 × 4.5–6.1 cm, eliptica a eliptico-ovada, aguda a largo-acuminada, basalmente asimétrica, con lóbulos obtusos, el lobulo basal tan largo como el pecíolo y a menudo sobrelapandolo, pinnatinervada ⅓ de su longitud, con 3–4 pares de nervios secundarios, divergiendo en angulos de 45°, distalmente curvados, no ramificados, impresos en la haz, levemente elevados en el envés, venación terciaria formando areolas rectangulares (0.8 × 0.3 cm), evidentes por ambas superficies, oscuramente glandulares, marginalmente ciliada, haz glabrescente y nervio medio corto piloso, envés con nervios medio y secundarios densamente pilosos, delgado-membranácea cuando seca, verde nítida en la haz, verde pálida en el envés. Profilos caducos, ovados, 0.8–10 mm de long., apicalmente acuminados a obtusos, glabros, delgado-membranáceos, verde pálidos cuando secos. Inflorescencias erectas en todos los estadios, blancas en flor, verdes en fruto; pedúnculo filiforme, 1.8–4 cm de long., 0.3–0.5 mm de diám., eglandular, corto-piloso, glabrescente; raquis 2.5–4 cm de long., 2–3 mm de diám. en fruto, oculto por las flores, eglandular, corto-piloso. Brácteas florales vistas desde arriba estrechamente deltoides, 0.5–0.8 mm de anchura, marginalmente glabras, corto-pilosas en su parte posterior, sin formar bandas alrededor de la espiga. Flores densamente agrupadas; estambres cuatro, filamentos 2.4 mm de long., anteras 0.4–0.5 mm de long., 0.1–0.2 mm de ancho, lateralmente dehiscentes, conectivo eglandular; pistilo con un estilo largo y filiforme de 1.2–1.4 mm de long. en fruto, eglandular, glabro. Fruto globoso, ovoide, largo-apiculado, 0.5–0.9 mm de diám.

Etimología. "Dolichostylum" hace referencia a la apreciable longitud del estilo.

Distribución y habitat. Piper dolichostylum sólo se conoce de una colección en la cuenca alta del río Caquetá, en la vertiente oriental andina de los Andes, departamento del Putumayo, al sur de Colombia, aproximadamente entre 1350 a 1450 m alt.

Otras especies del género *Piper* que ocurren con frecuencia allí son *P. aequale* Vahl, *P. filistilum* C. DC., *P. friedrichstahlii* C. DC., *P. immutatum* Trelease, *P. moliiusculum* Sodiro, *P. montanum* C. DC., *P. oroense* Yuncker, *P. saltuum* C. DC., *P. umbriense* Trelease & Yuncker, *P. trianae* C. DC. y *P. cumanense* Kunth.

Los bosques donde crece *Piper dolichostylum* en el departamento del Putumayo, se pueden catalogar dentro de la zona de vida del bosque pluvial premontano (Espinal, 1990). Estos bosques se caracterizan por tener gran riqueza de especies de las familias Lauraceae, Rubiaceae y Sapotaceae (Franco et al., 1995); los géneros más diversos son *Inga* (Mimosaceae), *Miconia* (Melastomataceae), *Otoba* (Myristicaceae), *Philodendron* (Araceae), *Pouteria* (Sapotaceae) y *Psychotria* (Rubiaceae). Dentro de la comunidad vegetal, las especies más importantes ecológicamente (con mayor valor de importancia) son *Clidemia cf. caudata* (Triana) Cogniaux (Melastomataceae), *Coussarea cf. bernardii* Steyermark (Rubiaceae), *Piper* sp. (Piperaceae), *Pouteria sp.* (Sapotaceae) y *Tovomita weddelliana* Planchon & Triana (Clusiaceae) (Franco et al., 1995).

Relaciones taxonómicas. Piper dolichostylum está estrechamente relacionado con *P. quitense* C. DC., especie que ocurre a mayores elevaciones (2300–2800 m alt.) y que tiene una distribución más amplia, pues se extiende desde el Macizo Colombiano, en el departamento del Huila, hasta los alrededores de Quito en el Ecuador. Las dos especies son muy similares en cuanto al hábito, forma, base y tamaño de las hojas, profilos, número de estambres, forma y tamaño del fruto y a los estilos prominentes. Ambos taxones pueden separarse utilizando la siguiente clave:

1a. Hojas marginalmente ciliadas, nervio medio en la haz y nervación en el envés pilosa; pedúnculo 1.8–4 cm de long. y piloso; inflorescencias 2.5–4 cm de long . . . . . *P. dolichostylum*

1b. Hojas marginalmente eciliadas, glabras; pedún-

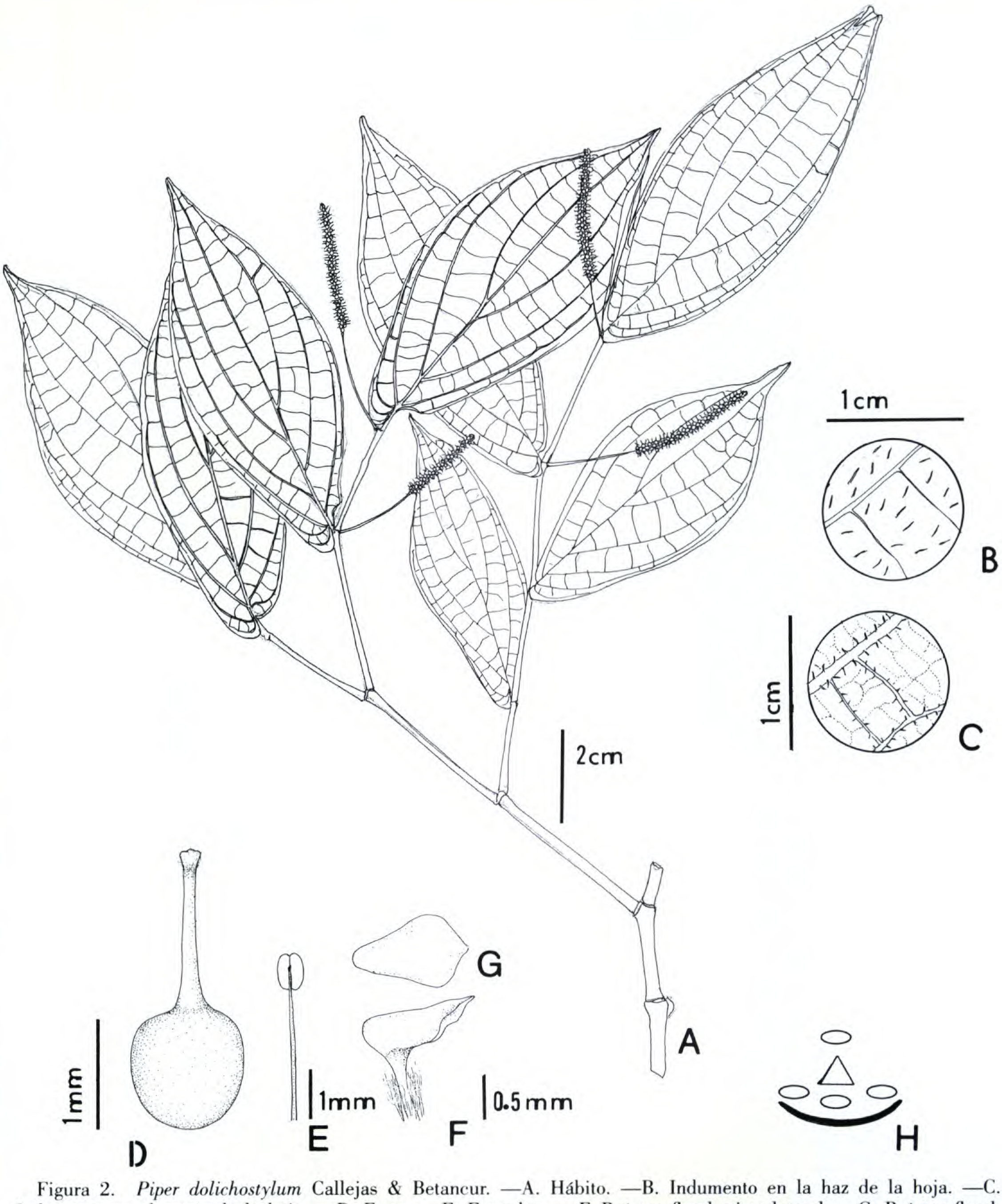

Figura 2. *Piper dolichostylum* Callejas & Betancur. —A. Hábito. —B. Indumento en la haz de la hoja. —C. Indumento en el envés de la hoja. —D. Fruto. —E. Estambre. —F. Bráctea floral, vista lateral. —G. Bráctea floral, vista de arriba. —H. Diagrama floral. De *J. L. Fernández et al. 11009* (COL).

culo 0.8–1 cm de long. y glabro; inflorescencia 0.5–1.6 cm de long . . . . . *P. quitense*

Piper curvinervium Callejas & Betancur, sp. nov. TIPO: Colombia. Cauca: municipio El Tambo, corregimiento 20 de julio, km 56 carretera Timbío–20 de Julio, 2500 m alt., 14 oct. 1974 (fl), *P. J. M. Maas & T. Plowman 2084* (holótipo, COL). Figura 3.

Frutex parvus 0.8–1.5 m altus, pauciramosus; ramulis dense longe velutino-tomentosis. Folia brevipetiolata, petiolo 3–5 mm longo, alato-vaginante, alis deorsum caulem base amplectentibus eo latioribus, 1.2–1.5 mm longis, integris, persistentibus; lamina ovato-elliptica, basi inaequilatera leviter cordiformi, supra nitida viridi, dense tomentosa, infra pallide viridi secus nervos dense tomentosa, venulis lateralibus 8–10, curvatis. Inflorescentia prophyllo 0.6–1.3 cm longo; pedunculo 1.5–2.5 cm longo, 0.8–1.1 mm diametro; rhachidi 3–3.5 cm longa;

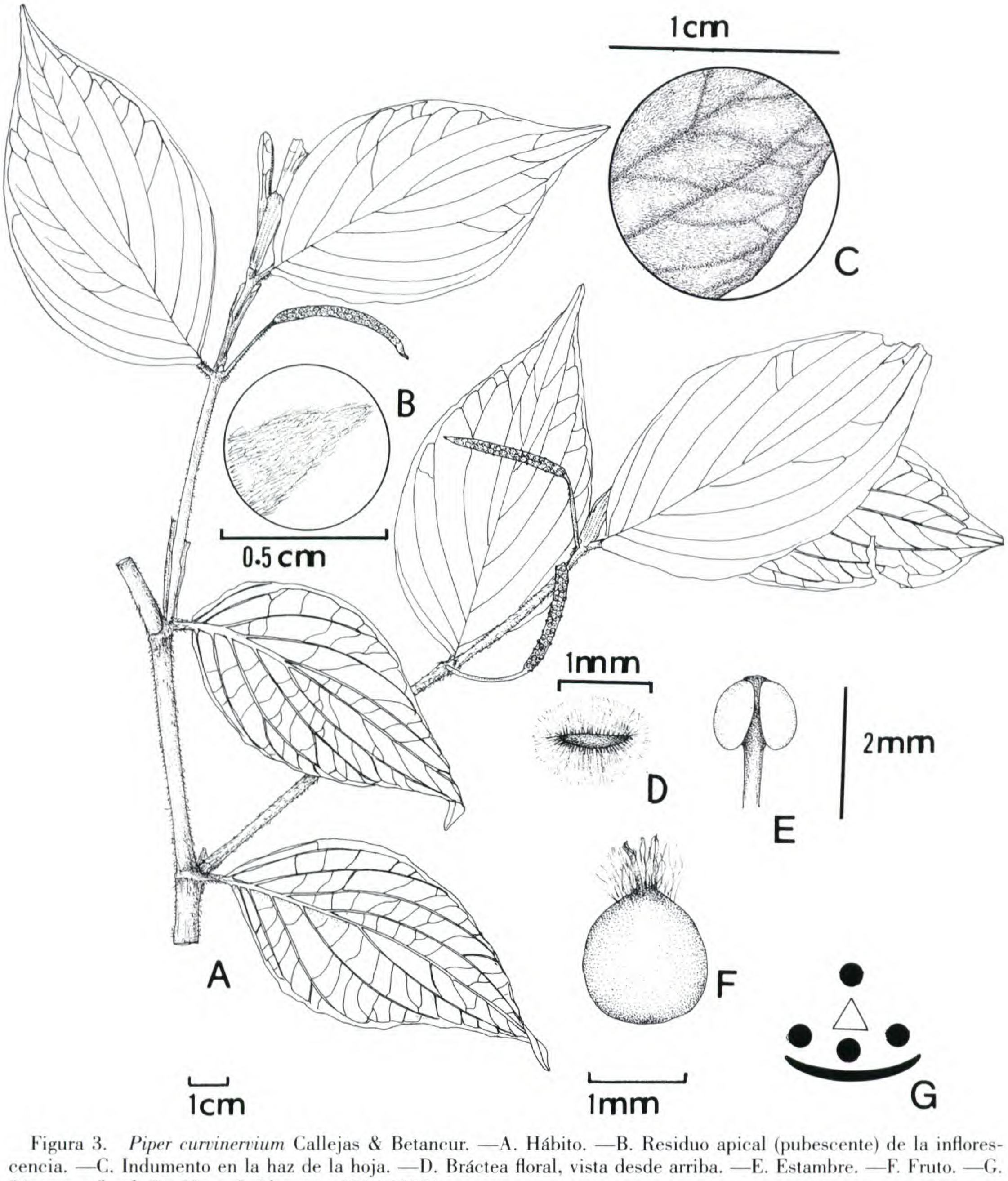

Figura 3. *Piper curvinervium* Callejas & Betancur. —A. Hábito. —B. Residuo apical (pubescente) de la inflorescencia. —C. Indumento en la haz de la hoja. —D. Bráctea floral, vista desde arriba. —E. Estambre. —F. Fruto. —G. Diagrama floral. De *Maas & Plowman 2084* (COL).

bracteis deltoideis, dense albo-fimbriatis. Flos androecio tetramero; stylo brevi strigose. Bacca globosa, 1.5 mm diametro, glabra.

Arbusto pequeño de 0.8–1.5 m de altura, laxamente ramificado, tallo principal y ramas de 1.1–3 mm de diám., entrenudos (3)5.5–7.5 cm de long., oscuramente glandular-punteado, velutino-tomentoso, indumento conformado por tricomas septados de 10–12 células, uniseriados, 0.3–0.5 mm de long., blancos. En todos los nudos los ápices caulinares emergen cubiertos por el profilo y están ocultos por las márgenes estipulares de la base de los peciolos. Hojas corto-pecíoladas, pecíolos 3–5 mm de long., 1 mm de diám., densamente tomentosos, con márgenes estipulares prominentes que se extienden ¾ de la longitud del pecíolo y amplexicaules, formando un cilindro de 0.8–1.2 cm de long., cubriendo el entrenudo y persistente, densamente glandular-punteado, ciliado-tomentoso, cartáceo cuando seco, marrón en ambas caras.

Lámina ovada a ovado-elíptica, 8–9.6 × 4–5.1 cm, apicalmente corto-aguda a largo-acuminada, basalmente obtusa, inequilatera, levemente cordada, pinnatinervada ⅓ de su longitud, con 4–5 pares de venas secundarias, divergiendo en ángulos de 45°, curvadas distalmente, levemente sulcadas en la haz, prominentes en el envés, venación terciaria formando areolas rectangulares-oblícuas de 6 × 4 mm, inconspicuas en la haz, evidentes en el envés, glandular-punteadas en el envés, con glandulas de color naranja, densamente velutino-tomentosas en la haz, tomentosas en el envés a lo largo de las venas principales, cartáceas cuando secas, verde nítidas en la haz, verde pálidas en el envés, ocre cuando secas. Profilos caducos, naviculares, ovados, 0.6–1.3 cm de long., apicalmente acuminado-truncados, densamente tomentosos a lo largo del nervio medial, delgado-membranáceos a cartáceos, marrón cuando secos. Inflorescencias erectas y blancas en flor, levemente curvadas, verde-pálidas en fruto; pedúnculo 1.5–2.5 cm de long., 0.8–1.1 mm de diám., oscuramente glandular-punteado, tomentoso; raquis distalmente apiculado, 3–3.5 cm de long., 2.8–3.5 mm de diám. en fruto, oculto por las flores, oscuramente glandular-punteado, glabro; brácteas florales estrechamente deltoides vistas desde arriba, 0.9–1.5 mm de ancho, marginalmente fimbriado-tomentosas, centralmente glabras, formando bandas en la antesis alrededor de la espiga. Flores densamente agrupadas en todos los estadíos; estambres cuatro; filamentos 0.4 mm de long., anteras 0.8 mm de long., y 0.3 mm de ancho, conectivo glandular-punteado; pistilo cónico, estilo corto y estrigoso. Fruto globoso, 1.4–1.5 mm de long., apicalmente con un estilo corto, oscuramente glandular-punteado.

Etimología. Los 4–5 pares de venas secundarias, equidistantes y curvadas hacia las márgenes, son el caracter conspicuo y diagnóstico para distinguir a *Piper curvinervium* de otras especies dentro del género.

Distribución y hábitat. Piper curvinervium es una especie endémica del Peniplano de Popayán (departamento del Cauca), de donde es conocida de una sola colección, en la vertiente oriental de la cordillera occidental de Colombia. El área está localizada en inmediaciones del Parque nacional Natural de Munchique y de acuerdo a la colección tipo, la especie crece en zonas boscosas y con pendientes pronunciadas y rocosas.

El área de Munchique cubre una extensa zona de bosques pluviales y nublados, relativamente bien conservados y que están dominados en su estrato arbóreo por robles (*Quercus humboldtii* Bonpland) y por encenillo (*Weinmannia* spp.), sobre suelos derivados en su mayor parte de cenizas volcánicas y con una precipitación unimodal y promedio anual de cerca de 5000 mm (Inderena, 1986). La región es particularmente rica en especies de las familias Araceae (Croat, 1992), Bromeliaceae, Ericaceae, Gesneriaceae, Orchidaceae y Piperaceae (Inderena, 1986).

El género *Piper* está representado en el área por cerca de 30 especies, entre las cuales se encuentran *P. cinereum* C. DC., *P. cornifolium* Kunth, *P. eriopodon* (Miquel) C. DC., *P. fendlerianum* C. DC., *P. montanum* C. DC. y *P. trianae* C. DC.

Relaciones taxonómicas. Piper curvinervium se distingue fácilmente por la siguiente combinación de caracteres: hojas pinnatinervadas con 4–5 pares de venas secundarias, equidistantes, curvadas distalmente (similares en apariencia con algunas especies del género *Cornus*), densamente velutino-tomentosas (aterciopeladas) en la haz, pecíolos con un desarrollo estipular amplexicaule y cilíndrico, persistente y que cubre parcialmente el profilo, y frutos globosos, corto-apiculados, con estigmas subsésiles sobre un estilo corto y estrigoso.

Los pecíolos con el desarrollo estipular prominente y amplexicaule y los profilos naviculares en todos los nudos, son diagnósticos para un pequeño grupo de especies andinas de *Piper,* las cuales son características de bosques pluviales e incluyen a *P. boquianum* Trelease & Yuncker, *P. fendlerianum* C. DC. y de dos especies aún no descritas de la cordillera central colombiana, en el nororiente de Antioquia.

El grupo es muy posiblemente monofilético y está conformado por pequeños arbustos, laxamente ramificados, umbrófilos que aparentemente se restringen a zonas pendientes y boscosas; si bien similares en su arquitectura a otras especies del género, son los únicos taxa en donde todos los nudos poseen profilos y pecíolos con desarrollos estipulares prominentes, condición que no es frecuente en *Piper,* en donde por lo general los desarrollos estipulares son prominentes solo en nudos estériles y si se presentan en nudos fértiles, entonces los prófilos son diminutos y pobremente desarrollados (Burger, 1971).

Piper curvinervium está claramente emparentado con *Piper fendlerianum* C. DC., el cual posee hojas con venas secundarias no equidistantes, que divergen hasta los ⅔ del nervio medio, glabras en la haz (estrigosas en el envés), pecíolos con desarrollo estipular de 0.4–0.8 cm de long., caducos, los tallos estrigosos, pedunculos de 1 cm de long., e inflorescencias de 3–5 cm de longitud.

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A New Species of *Mentzelia* Section *Bartonia* (Loasaceae) from Arizona

Charlotte M. Christy
Department of Botany, Arizona State University, Tempe, Arizona 85287-1601, U.S.A.
Current Address: Biology Department, Augusta State University,
Augusta, Georgia 30904-2200, U.S.A.

ABSTRACT. A new species of *Mentzelia* sect. *Bartonia* (Loasaceae), *M. collomiae*, is described from central Coconino County, Arizona, U.S.A. It is an edaphic endemic species restricted to cinder areas of the San Francisco Volcanic Field and is distinguished from other species in the section by seed surface features and by a combination of gross morphology, chromosome number, and habitat.

Mentzelia sect. *Bartonia* (Sims) Gilg contains about 35 species of mostly western North American short-lived perennials. Ongoing studies in *M.* sect. *Bartonia* and preparation of the Loasaceae treatment for the Vascular Plants of Arizona project have confirmed the existence of a new species in Arizona. This taxon was apparently first recognized in the mid 1960s by H. J. Thompson and J. R. Zavortink, as indicated by their annotations of several specimens of this taxon as "*M. volcanicola, n. sp.*" The same identification was given to other specimens in the mid 1970s in annotations by H. J. Thompson. Since this name was never validly published and since some of the specimens annotated as "*M. volcanicola*" represent *M. multiflora* (Nuttall) A. Gray, a different epithet is applied to this species.

Mentzelia collomiae Christy, sp. nov. TYPE: U.S.A. Arizona: Coconino Co., ca. 3.5 mi. due N of Sunset Crater National Monument, T24N, R8E, NE 1/4 Sec 26, 6350 ft., 25 Sep. 1994, *C. M. Christy 2385* (holotype, ASU; isotypes, MO, US).

Inter species sectionis *Bartoniae* ad *M. candelariam* H. J. Thompson & B. A. Prigge accedens sed cellulis testae multo magis colliculosis, staminodiis saepe praesentibus, solis natalibus omnino volcanicis, ab ea recedens.

Plant perennial from basal rosette, herbaceous to slightly suffrutescent; trichomes present nearly throughout, unicellular, barbed, the larger ones with surrounding cells enlarged, forming a basal pad. Stem 11–35 cm tall, 1–5 mm diam. near base, single (rarely 2), strict (occasionally arching from weight of fruits or nearly prostrate due to shifting substrate); axillary branches developing to base of stem in robust plants. Leaves of basal rosette oblanceolate, 1–3.5(–5) cm long, 3–10 mm wide, the margins with blunt teeth or short lobes distally; lower cauline leaves oblanceolate or narrowly elliptic to lanceolate, 1.5–5 cm long, 3–8(–14) mm wide, the margins with 3 (2–4) teeth or lobes per cm; cauline leaves gradually reduced upwardly, deltoid; lobes of upper leaves mostly triangular and acute, the basal pair of lobes often enlarged and clasping; uppermost leaves forming bracts, linear-lanceolate, 0.7–1.4 cm long, the margins entire or 1–2-lobed. Flowers pedicellate, not clustered, subtended by 1–2 bracts, these sometimes fused to base of ovary. Calyx lobes narrowly triangular, 3–8 mm long. Petals 5, yellow, wide-spreading, spatulate (nearly linear), 5–11 mm long, 2–4 mm wide; apices obtuse (in wider petals) or acute (in narrower petals); trichomes at apices and adjacent margins only. Petaloid staminodia 3–5 (or 0 when bearing small but apparently functional anthers), distinctly narrower and usually shorter than petals, 4–10 mm long, 1–2 mm wide; apex acute to long-attenuate. Stamens 30–50; outermost 3–8 mm long, the inner ones shorter, those of outer whorls with slightly broadened filaments. Ovary 3-carpellate, (4–)6–10 mm long at anthesis; style (3–)5–7 mm long, the stigmatic grooves 1–2 mm long, their papillae few, short, not forming a visible tuft. Capsule cylindrical, crowned with persistent calyx and style; body 6–17 mm long. Seeds white to pale tan, oval or subrectangular to suborbicular, 1.8–2.6 mm long, 1.5–1.9 mm wide, the wing (0.15–)0.2–0.25 mm wide; testa cells (10× magnification) visible and appearing smooth; testa cells (100× magnification) nearly isodiametric, mostly regularly arranged, the radial walls straight, the tangential walls with a colliculate dome of 15–30 small coalesced bumps, the number varying with cell size. Chromosome number: $n = 11$.

Phenology. Flowering occurs from (June) July

to October and is asynchronous within a population; mature fruits are usually present from late July through November. Flowers open during at least two days. They begin opening in early evening and close after dusk, with those opening for the first time following the pattern I have observed in other taxa of section *Bartonia* and opening later than older flowers. No pollinators have been observed.

Distribution and habitat. Known only from ca. 110 square miles of the San Francisco Volcanic Field in central Coconino County, Arizona, where it occurs on relatively undisturbed slopes and surrounding flats of volcanic cinder cones in and around Sunset Crater National Monument (SCNM; 35°15′–27′N; 111°22′–32′W). An isolated western population grows on a similar substrate at Red Mountain (35°31′N; 111°52′W), ca. 30 miles to the northeast of SCNM. This edaphic endemic species is restricted to a substrate consisting of black (occasionally reddish), volcanic cinders, with surface layers mostly ca. 1 cm in diameter. At SCNM, this substrate is less than 1000 years old (Breternitz, 1967), has little apparent soil development, and is commonly barren or only sparsely vegetated. *Mentzelia collomiae* has not been observed on black cinder substrates that are the consistency of coarse sand (e.g., at Merriam Crater) or on areas primarily composed of large, coarse cinders or lava fragments. The reddish coarse cinders with denser vegetation and visible soil development that characterize the majority of cinder cones outside the SCNM area also do not provide a suitable habitat. Dominant plants in the SCNM area commonly include *Pinus ponderosa* Douglas ex Lawson & C. Lawson, *P. edulis* Engelmann, and *Juniperus* spp. Populations of *M. multiflora* occur in the vicinity of *M. collomiae* populations throughout its range, but the former are restricted to areas with evident soil build-up. I have seen no evidence of hybridization between these two taxa. Intermediate morphology, a lack of seed set, and sharply reduced pollen stainability characterize hybrids within *M.* sect. *Bartonia* (e.g., Thompson, 1963; Thompson & Zavortink, 1968).

In *Mentzelia,* seed surface sculpturing patterns are potentially diagnostic at the species level (Hill, 1976). This is true for *M. collomiae,* and this pattern, its chromosome number and floral morphology place it within a group of species that includes *M. candelariae. Mentzelia candelariae* occurs mostly on clay soils in western Nevada (Thompson & Prigge, 1984). The surface sculpturing of its seeds is more coarsely colliculate and it has five broadened stamens but no petaloid staminodia. *Mentzelia multiflora* is normally a much larger, more robust plant that can be readily distinguished from *M. collomiae* by its larger flowers (petals commonly 15–20 mm long) and testa cells with highly sinuate radial walls.

The specific epithet honors Rose E. Collom, an amateur botanist in Arizona during the 1930s and one of the first to collect this species.

Paratypes. U.S.A. **Arizona:** Coconino County, Sunset Mtn. at Flagstaff, 21 Aug. 1915, *Rusby s.n.* (NY); near Sunset Crater, 7000 ft., 1 July 1937, *Collom 743* (ASU, DES); Wupatki Nat'l. Mon., top of cinder cone, 7000 ft., 27 July 1939, *Jones s.n.* (ARIZ); SCNM, NE of Flagstaff, 14 Aug. 1950, *Deaver 2986* (ASC); SCNM, NE of Flagstaff, 7000 ft., 18 July 1959, *Carson 23* (ASC); S side of Sunset Cone, SCNM, 7400 ft., 24 June 1964, *Eggler 839* (MNA); Red Mountain, 35 mi. NW of Flagstaff on Hwy. 180, 7400 ft., 10 Aug. 1978, *Peterson 78-91* (MNA); 0.5 mi. E of SCNM, T23N, R9E, Sec19, 6800 ft., 7 Oct. 1990, *Christy 432 & Parfitt* (ASU); ENE of Flagstaff, Cochrane Hill cinder pit, ca. 0.5 mi. N of Leupp Rd., T22N, R10E, SW 1/4 Sec19, 6350 ft., 15 Aug. 1991, *Christy 842* (ASU, TEX); ENE of Flagstaff, ca. 1.5 mi. due N of Leupp Rd. along Forest Rd. 244, T22N, R9E, SW 1/4 Sec15, 6400 ft., 12 Sep. 1992, *Christy 1152* (ASU); 4 mi. SE SCNM along Forest Rd. 498, T22N, R9E, SE 1/4 Sec5, 6900 ft., 12 Sep. 1992, *Christy 1155* (ASU); ENE of Flagstaff, ca. 4 road-mi. N of Leupp Rd. along Forest Rd. 244, T22N, R9E, NW 1/4 Sec15, 6500 ft., 6 Sep. 1993, *Christy 1878* (ASU); NE side of Red Mtn., ca. 35 mi. NW of Flagstaff, T25N, R4E, Sec21–22, 7200 ft., 24 Sep. 1994, *Christy 2372* (ASU, LA); ca. 3.5 mi. due N of SCNM, T24N, R8E, Sec25, 6200 ft., 24 Sep. 1994, *Christy 2383* (ASU); 2.5 mi. N of SCNM, cinder ridge just NW of Black Mtn., T24N, R8E, Sec36, 6400 ft., 24 Sep. 1994, *Christy 2384* (ASU, WS).

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New Species of *Alyxia* Banks ex R. Brown (Apocynaceae) and *Glochidion* J. R. & J. G. Forster (Euphorbiaceae) from the Pitcairn Islands (South East Pacific)

J. Florence

ORSTOM, Muséum national d'Histoire naturelle, Laboratoire de Phanérogamie, 16, rue Buffon 75005 Paris, France; e-mail: florence@mnhn.fr

ABSTRACT. *Alyxia fosbergii*, endemic to Henderson Island, and *Glochidion comitum*, endemic to Pitcairn, are here described as new.

During fieldwork conducted as part of the Sir Peter Scott Commemorative Expedition to the Pitcairn Islands—PISE (1992), a botanical survey with extensive observations and collections was made of the flora and the vegetation of these islands (Florence et al., 1995; Waldren et al., 1995).

Alyxia (Apocynaceae) is distributed throughout South East Asia, Malesia, Australia, and the Pacific, where it extends to Henderson, its eastern limit. With about 120–130 species, this genus is represented in Polynesia by *A. scandens* (J. R. & J. G. Forster) Roemer & Schultes, *A. stellata* (J. R. & J. G. Forster) Roemer & Schultes, and their relatives (Fosberg, 1968; Fosberg & Sachet, 1974; Grant et al., 1974; A. Smith, 1988). I describe here a new species belonging to this group.

Alyxia fosbergii Florence, sp. nov. TYPE: Pitcairn Islands. Henderson: Piste Camp Nord–Camp Sud, km 3.5, 128°19′W, 24°21′S, 25 m, 13 May 1991, *Florence, Chepstow-Lusty & Waldren 10893* (holotype, K; isotypes, BISH, P, PAP, TER, US). Figure 1.

Ab *A. stellata* var. *stellata*, 4–5 verticillatis latioribusque foliis, majoribus trifloris cymis, majoribus floribus cum longioribus pedicellis, pilis minus densis ovarii base, ellipticis valde transverse sulcato-rugosis seminibus, praecipue differt.

An erect or ± scandent, glabrous subshrub to shrub, about 8 m high, the trunk ca. 2 cm diam., simple or few-branched in the upper part, with arching-drooping branches and abundant milky latex. Leaves generally verticillate in whorls of 4, more rarely by 3 or 5. Lamina elliptic, rarely oblanceolate, 4.1–7.2 cm long and 1.3–2.5 cm wide (larger on sterile shoots), L/W = 3, margin entire, generally lightly revolute in sicco, apex obtuse, base attenuate on a petiole 1.5–3 mm long, costa canaliculate above, prominent beneath, nerves 12–20 pairs, sometimes furcate, inconspicuous to slightly apparent on both sides. Inflorescences glabrous, erect, axillary, in 3(4)-flowered cymes, peduncle 1.1–2.2 cm long, bracts triangular, up to 1.5 mm long. Flowers with a honey-like scent, bracteoles absent, pedicel 0.5–1.2 cm long; calyx deeply lobed, 2–3 mm high, lobes deltoid, 2 × 1 mm, glabrous or occasionally with sparse pubescence at the acute apex; corolla hypocrateriform, tube orange to salmon in vivo, about 8 mm long, slightly expanded at the point of insertion of stamens, constricted at the throat, glabrous outside, pubescent inside for the first 1.5 mm below the stamens, lobes cream to yellow in vivo, asymmetrically triangular, 5.5 × 3 mm; stamens inserted 3 mm below the throat, filaments glabrous, 0.4 mm, anthers narrowly lanceolate, 1.3 mm, apex acute; disk inconspicuous, ovary glabrous, 1.2 mm high, surrounded at the base by straight hairs ca. 0.4 mm long, style glabrous, about 4.5 mm, clavuncula cylindrical, glabrous at the base, apex with stiff hairs concealing the stigma. Fruit a pair of drupaceous mericarps on stipes ca. 5 mm, generally only one maturing, composed of a single article or very rarely two, ± ellipsoid, reaching 2 × 1 cm, black at maturity in vivo, short-beaked, glossy or slightly rugose in sicco; seed black, 1.5 × 0.8 cm, transversely strongly sulcato-rugose, ventrally deeply furrowed.

Distribution and common name. Endemic to Henderson, an upraised limestone island. Known as "maire," this is also the name given by the inhabitants from French Polynesia for *A. scandens* and *A. stellata*.

Ecology. Found in *Pisonia* forest at 20–30 m, on coral gravel or broken lapiaz, generally in sunny places, tree gaps, or the edges of paths.

Alyxia fosbergii is a relative of *A. stellata* from the South Pacific, of which several varieties have been described from East Polynesia to New Caledonia. The new species differs from *A. stellata* var. *stellata* by its consistently 4(–5) verticillate leaves, more elongate cymes, larger flowers, and seeds with

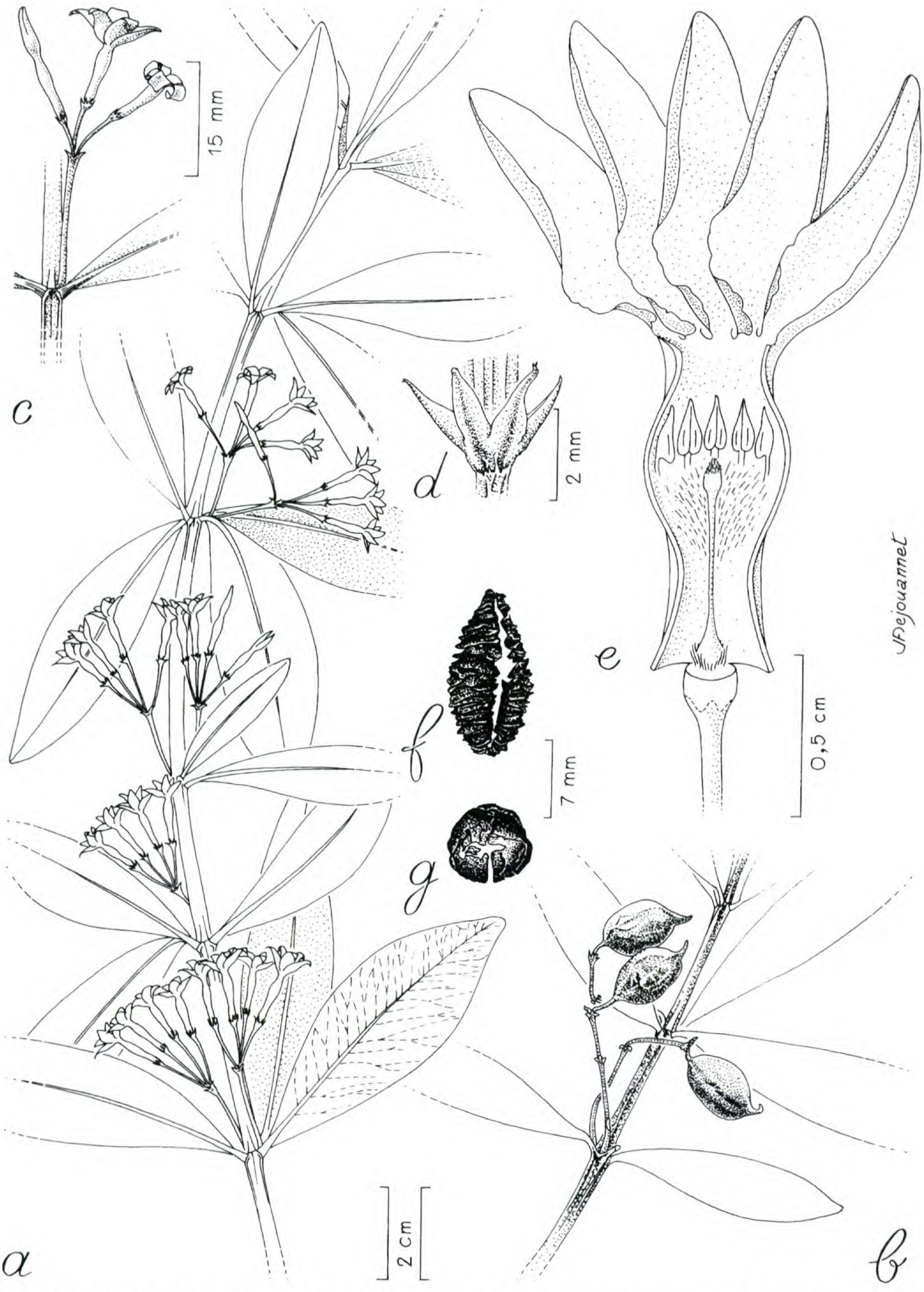

Figure 1. *Alyxia fosbergii* Florence. —a. Flowering branch. —b. Infructescence. —c. Inflorescence. —d. Calyx. —e. Corolla open, showing androecium and gynoecium. —f. Seed, longitudinal view. —g. Seed, cross section. (a, c–e, based on *Florence, Chepstow-Lusty & Waldren 10895*; b, f, g, based on *Florence 10959*.)

a more deeply rugose coat. This species was treated as *Alyxia stellata* by Saint John and Philipson (1962: 192) and *Alyxia* sp. by Fosberg et al. (1989: 9) and Florence et al. (1995: 84).

The species is named in honor of the late F. R. Fosberg, who was the first to point out the distinctness of the material of Henderson Island (1989: 9), but was not able to publish it as new before his death.

Paratypes. PITCAIRN ISLANDS. **Henderson:** Piste Camp Nord–Camp Sud, km 0.75, 24°20′S, 128°19′W, 30 m, 3 May 1991, *Florence 10848* (BISH, K, P, PAP, US), 24°20′S, 128°19′W, km 0.6, 30 m, 7 June 1991, *Florence 10959* (BISH, K, P, PAP); Piste Camp Nord–Camp Ouest, 24°20′S, 128°20′W, 30 m, 12 May 1991, *Florence, Chepstow-Lusty & Waldren 10887* (PAP); Piste Camp Nord–Camp Sud, km 4.6, 24°22′S, 128°19′W, 30 m, 13 May 1991, *Florence, Chepstow-Lusty & Waldren 10895* (BISH, E, K, MO, P, PAP, TER, US, WAG), km 6.7, 24°23′S, 128°20′W, 35 m, 15 May 1991, *Florence, Chepstow-Lusty & Waldren 10918* (P, PAP), km 0.8, 24°20′S, 128°19′W, 30 m, 23 May 1991, *Florence, Chepstow-Lusty & Waldren 10927* (PAP); Henderson: 3–4 Feb. 1957, *Lintott H.4* (BISH); Henderson: North End, 33 m, 18 June 1934, *Saint John & Fosberg 15127* (BISH 2 sheets, P); North Center, 30 m, 20 June 1934, *Saint John & Fosberg 15168* (BISH 2 sheets), 30 m, 20 June 1934, *Saint John & Fosberg 15178* (BISH, 2 sheets, K); Henderson: Aug. 1912, 100 ft., *Tait 46* (BISH).

The genus *Glochidion* occurs mainly in tropical Asia, Malesia, and the Pacific. With probably over 200 species, this genus is considered to be taxonomically difficult, with poorly defined characters. Vegetative features and male flowers are uniform in the region, but careful attention to the female flowers makes it possible to delimit taxa within this highly differentiated group, at least in the Pacific basin. I describe here a new species related to the species in East French Polynesia.

Glochidion comitum Florence, sp. nov. TYPE: Pitcairn Islands. Pitcairn: Sommet Crête Sud-Est, 25°4′S, 130°7′W, 300 m, 19 Apr. 1991, *Florence 10740* (holotype, K; isotypes, BISH, BM, DAV, E, L, MO, P, PAP, TER, US). Figure 2.

A *G. taitense* Baillon ex Mueller-Argau, brunneo rubente indumento vestitis ramis, minore hirsuto pedicello solitaris femineis floribus, conico vel subgloboso plerumque plurilocullariore sparse sericeo indumento vestito ovario, breviore quam stylo, praecipue differt.

A shrub or tree 2.5–4 m high, the trunk 2–5 cm diam., branches plagiotropic, young twigs covered with a dense brown reddish pubescence. Leaves alternate, distichous. Lamina ovate to oblong, falcate, generally asymmetrical, reaching 5.2–9.7 cm long and 3.2–6.3 cm wide (smaller on regrowth shoots), L/W = 1.7, sparsely pubescent to glabrous above, sparsely soft pubescent beneath, margin entire, apex acute, slightly acuminate, obtuse or rounded, base cuneate, unequally cuneate, truncate or slightly subcordate, petiole 1.5–3 mm long, costa and nerves raised above, prominent beneath, nerves 4–6 pairs, stipules narrow, unevenly deltoid, about 1 mm high. Male flowers glabrous, slightly fleshy, axillary and solitary or in pairs, more rarely with a female, 2–2.4 mm long, 3(very rarely 4)-merous, yellow green in vivo, pedicel reflexed, glabrous, swollen below the calyx, reaching 5–7.5 mm long, calyx cupuliform, about 2.2 mm, outer tepals ovate, 1.9 × 1.3 mm, inner tepals, ovato-oblong, 1.7 × 1.2 mm, subsessile staminate columm of 3(4) stamens, 1.3 mm high, connective prolonged in a narrow triangular appendage, 0.3 mm long. Female flowers axillary and solitary or rarely with a male flower, 1.8–2.2 mm, pedicel hirsute, swollen below the calyx, reaching 1–2 mm long, calyx cupuliform, 1.3 mm, outer tepals deltoid, 1.1 × 1 mm, inner tepals, ovato-oblong, 0.9 × 0.7 mm, generally outside sparsely pubescent along their midribs with hairs of the same type as on the pedicel, ovary conical or subglobose, 4–7 locular, about 0.7 mm high and 0.85 mm wide, with short white pubescence, prolonged into a slightly 4–7 emarginate, glabrous style, 1.2–1.5 times its length. Fruit on an accrescent pedicel about 5 mm long, both covered by a ± dense and persistent pubescence, the body of fruit 1.3 cm wide and 0.4 cm high, slightly 4–6 sulcate, with a ± persistent calyx; seeds plano-convex, 2.2 mm high and 2.6 mm wide, testa fleshy.

Distribution. Known only from Pitcairn, the chief island of the Pitcairn group.

Ecology. Found in open stations, at the edges of disturbed *Homalium-Syzygium* or *Ficus-Aleurites* forests or in open shrubby *Psidium-Sorghum* community; apparently rare.

This is a striking species, pointed out as *Glochidion* sp. by Florence et al. (1995: 103), belonging to a group of taxa of east Polynesia characterized by a pubescent ovary with 4–7 locules. It has remote affinities with the group centered around *G. taitense* Baillon ex Mueller-Argau, from which it differs by a more massive ovary and a shorter massive stylar column. The same features place it near undescribed material of the Society Leeward Islands that is currently under study as part of a revision of the genus in French Polynesia.

The specific epithet is derived from the Latin "comes," meaning companion. This new taxon is dedicated to Alex Chepstow-Lusty and Steve Waldren, the two botanists who were my field compan-

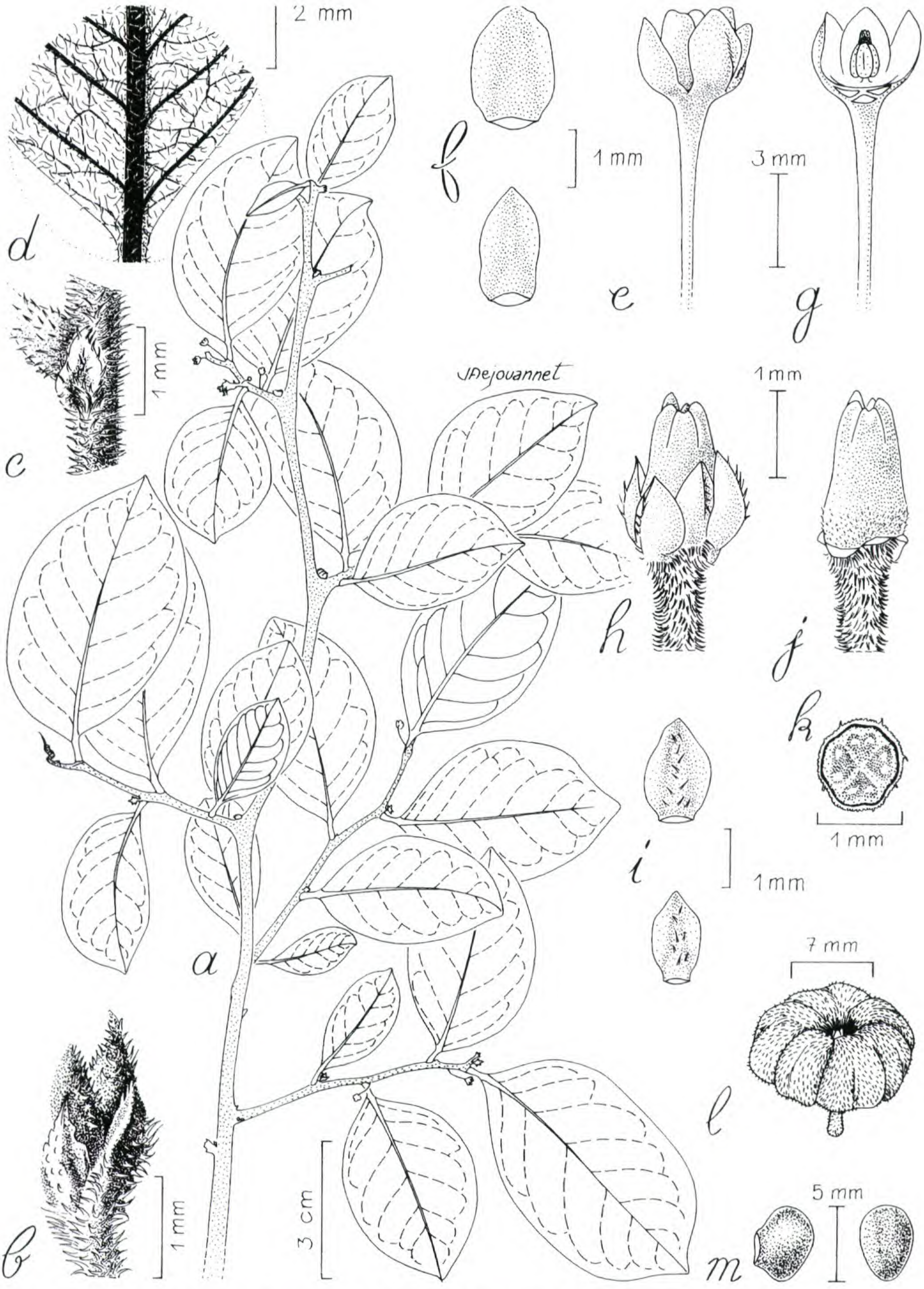

Figure 2. *Glochidion comitum* Florence. —a. Habit. —b. Detail of apex of shoot. —c. Stipule. —d. Detail of base of leaf, ventral view. —e. Male flower. —f. Outer and inner tepal, dorsal view. —g. Androecium, front tepals removed. —h. Female flower. —i. Outer and inner tepals, dorsal view. —j. Gynoecium. —k. Cross section of ovary. —l. Fruit. —m. Seed, lateral and dorsal view. (a–k, based on *Florence 10740*; l, m, based on *Florence & Chepstow-Lusty 10754*.)

ions on the expedition during which the type material was collected.

Paratypes. PITCAIRN ISLANDS. **Pitcairn:** Route Sud-Est de la Radio Station, 25°4′S, 130°6′W, 95 m, 18 Apr. 1991, *Florence 10728* (BISH, K, P, PAP, US), Sommet crête Sud-Est, 25°4′S, 130°7′W, 300 m, 19 Apr. 1991, *Florence & Chepstow-Lusty 10754* (P, PAP); Route Sud-Est de la Radio Station, 25°4′S, 130°6′W, 160 m, 18 Apr. 1991, *Florence & Chepstow-Lusty 10730* (BISH, E, K, MO, P, PAP, TER, US); Pitcairn: Fatlands, 100 m, 13.6.1934, *Fosberg & B. Christian 11237* (BISH).

Acknowledgments. I am grateful to the Pitcairn Island Commissioner and Council for permission to visit the islands. I am especially grateful to the people of Pitcairn for their hospitality during my stay on the island, in particular Reynold & Nola, Terry & Yula, and Brian & Karrie. My visit as part of the Sir Peter Scott Commemorative Expedition to the Pitcairn Islands was supported by the following major sponsors: The Royal Society, the International Council for the Preservation of Birds, the British Ornithologists Union, J. A. Shirley, the Foreign & Commonwealth Office UK, UNESCO; other sponsors are mentioned in the Expedition Report (1992). This is paper 57 of the Sir Peter Scott Commemorative Expedition to the Pitcairn Islands. I thank the curators of BISH, K, and P for access to or loan of specimens. I am grateful to P. P. Lowry for advice on the manuscript. Special thanks go to J.-F. Dejouannet for his excellent illustrations.

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Gamochaeta lulioana (Asteraceae, Gnaphalieae), una Nueva Especie de los Andes de Bolivia y Perú

Susana E. Freire y Laura Iharlegui

Departamento Científico de Plantas Vasculares, Museo de La Plata, Paseo del Bosque s.n., 1900 La Plata, Argentina

RESUMEN. Se describe e ilustra una nueva especie de *Gamochaeta* de los Andes de Perú y Bolivia. *Gamochaeta lulioana* es similar a *G. longipedicellata* por su hábito cespitoso y los capítulos solitarios, pero se diferencia de ésta por los capítulos sésiles.

ABSTRACT. A new Andean species, *Gamochaeta lulioana*, is described and illustrated. This species is closely related to *G. longipedicellata*, which occurs in Argentina. Both species are similar in their caespitose habit and solitary capitula, but only *G. lulioana* has sessile capitula.

El género americano *Gamochaeta* Weddell comprende cerca de 52 especies herbáceas (Anderberg, 1991) principalmente sudamericanas; sólo 8 o 9 especies llegan a América del Norte y 3 especies son nativas de América Central. La mayor parte de las especies de *Gamochaeta* son muy parecidas entre sí (Cabrera, 1961); hierbas anuales o perennes con hojas obovadas a espatuladas, capítulos pequeños comúnmente reunidos en pseudoespigas o cabezuelas, papus unido en un anillo en la base, flores femeninas superando en número a las hermafroditas, estilo truncado con una coronita de pelos en el ápice (Fig. 1H) y aquenios con cortos globosos pelos mucilaginosos (Fig. 1E). El género más afín a *Gamochaeta* es *Stuckertiella*. Sin embargo, *Gamochaeta* se diferencia por sus corolas pentámeras o si tetrámeras (Fig. 1B) con apéndices de las anteras de igual tamaño (Fig. 1G), mientras que *Stuckertiella* presenta sus corolas del disco tetrámeras con uno de los apéndices de la antera de mayor tamaño (Anderberg, 1991; Dillon & Sagástegui A., 1991).

Gamochaeta lulioana S. E. Freire & Iharlegui, sp. nov. TIPO: Bolivia. La Paz: Cumbre de Yungas, 22 km de La Paz, ± 4600 m.s.m., 15 feb. 1950 (fl), *A. Krapovickas et A. M. Fuchs de K. 6763* (holótipo, LP). Figura 1.

Herba annua, pygmaea, caespitosa, 1 cm alta, radicibus filiformibus et caulibus tenuibus, valde abbreviatis, densissime foliosis, albido-tomentosis. Folia alterna valde approximata sessilia, oblongo-spathulata, obtusa, basibus paullo dilatatis, integerrima utrinque dense incano-tomentosa, 3–4 mm longa, 0.9–1 mm lata. Capitula heterogama pauca ex axillis foliorum, nascentia, sessilia. Involucrum campanulatum 4–6 mm altum; bracteis involucralibus glabrescentibus, apice acutis obscurisque, ca. 25, externis ovatis, internis oblongo-lanceolatis. Flores feminei ca. 27, corolla filiforme obsolete bilabiata ca. 3 mm longa. Flores disci ca. 8 hermaphroditi, corolla tubulosa tetradentata ca. 3 mm longa; styli ramulis apice truncatis pilosis, antherae 4 apicibus ovate aequilongis. Pappi setae albo-scabridiusculae basi annulum concretae. Achaenia minuta pilosa ca. 0.7 mm longa.

Hierba anual, pigmea de apenas un centímetro de altura, cespitosa, albo-tomentosa, con raíces filiformes, tallos abreviados, delgados y densamente foliosos. Hojas alternas, aproximadas, sésiles, enteras oblongo-espatuladas, obtusas en el ápice, ligeramente dilatadas y trinervadas en la base, albotomentosas en ambas caras, de 3–4 mm de largo por 0.9–1 mm ancho. Capítulos heterógamos, sésiles, pocos, naciendo en la axila de las hojas superiores. Involucro acampanado de 4–6 mm de altura; brácteas involucrales escariosas, glabrescentes, agudas y oscuras en el ápice, ca. de 25; las exteriores anchamente ovadas, las interiores oblongo-lanceoladas. Flores del radio femeninas ca. de 27, con corola filiforme, cortamente bilabiada en el ápice, de 3 mm de largo. Flores del disco hermafroditas, ca. de 8, con corola tubulosa, tetralobada de 3 mm de largo; estilo con ramas delgadas, truncadas con una coronita de pelos en la parte superior; anteras 4, con ápices ovados de igual longitud. Papus blanco formado por una serie de pelos escabrosos, soldados entre sí en la base. Aquenios de ca. de 0.7 mm de largo, cubiertos de cortos globosos pelos mucilaginosos.

Distribución y hábitat. Especie hallada hasta ahora únicamente en la Cumbre de Las Yungas, Departamento de La Paz, Bolivia y en Hacienda Sihuina, Departamento de Cuzco, Perú, donde crece en laderas secas a 4500 m.s.m.

Gamochaeta lulioana se parece a *G. longipedicellata* Cabrera por su hábito cespitoso y los capítulos solitarios, de la que difiere por sus capítulos sésiles y flores tetrámeras.

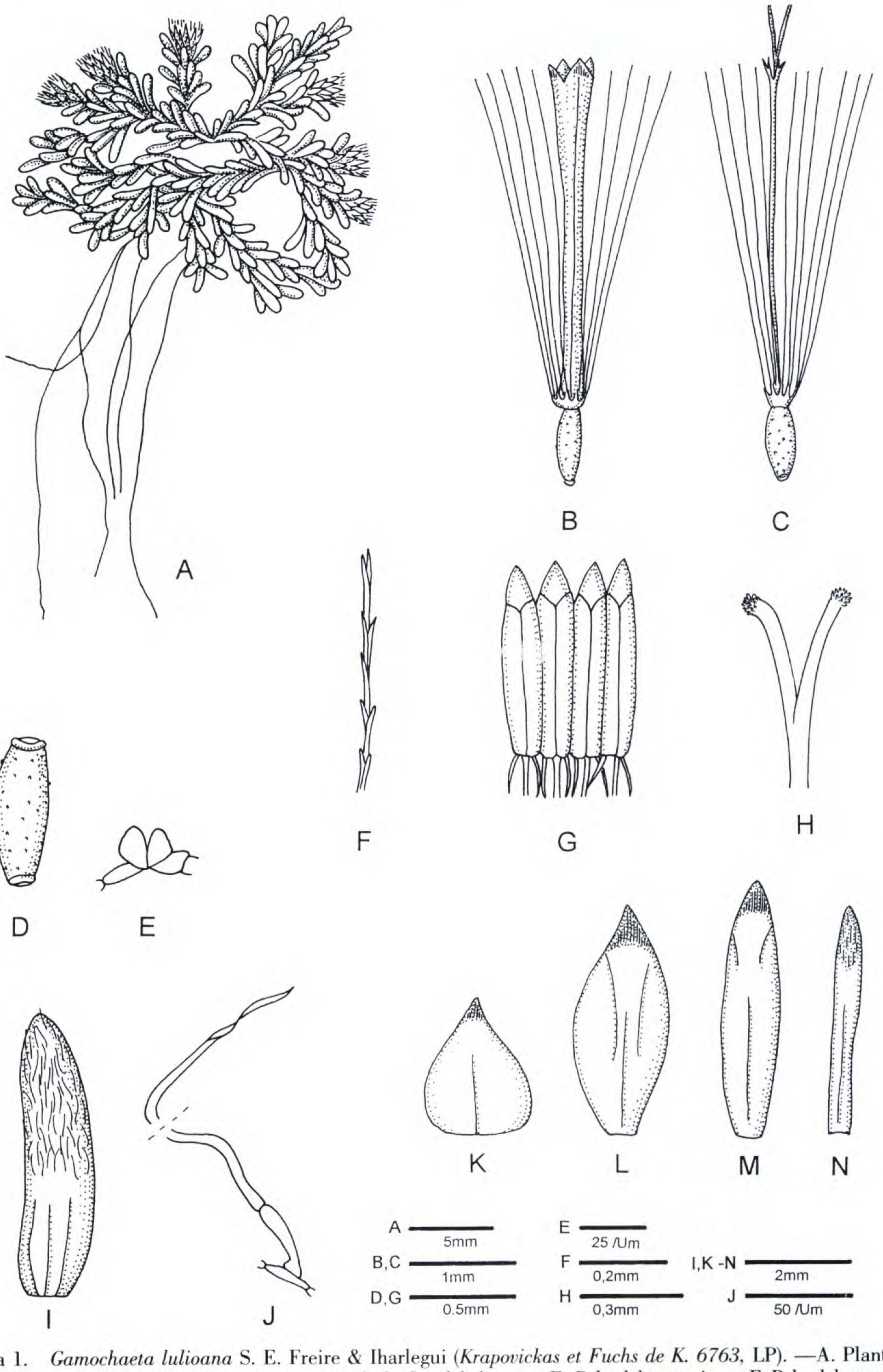

Figura 1. *Gamochaeta lulioana* S. E. Freire & Iharlegui (*Krapovickas et Fuchs de K. 6763*, LP). —A. Planta. —B. Flor del disco. —C. Flor del radio. —D. Aquenio de la flor del disco. —E. Pelo del aquenio. —F. Pelo del papus. —G. Anteras de la flor del disco. —H. Ramas estilares de la flor del disco. —I. Hoja. —J. Pelo de la hoja. —K–N. Brácteas involucrales.

Esta nueva especie es denominada en honor al eminente botánico doctor Angel Lulio Cabrera, que con entusiasmo, devoción e infatigable labor dedica su vida al conocimiento de la familia de las compuestas.

Parátipo. PERU. **Cuzco:** Provincia de Canchis, Hacienda Sihuina, laderas secas, 4500 m.s.m., mar. 1970 (fl), *E. Anterana F. N° 8* (*C. Vargas C. 21730*) (LP).

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Two New Species of *Chamaedorea* (Arecaceae)

Donald R. Hodel
University of California, 2615 S. Grand Ave., Suite 400, Los Angeles, California 90007, U.S.A.

ABSTRACT. *Chamaedorea ponderosa* from Panama and *C. christinae* from Colombia are named and described as new, and compared with related taxa.

Chamaedorea includes over 100 species of small, dioecious, pleonanthic, understory palms restricted to neotropical, mostly moist or wet, primary rain and cloud forests from eastern and western Mexico to northern Bolivia. The genus is most diverse in wet mountain forests from 800 to 1500 m elevation. The mountainous area of southern Mexico and adjacent Guatemala is the primary center of distribution; a secondary center is the mountainous area shared by Costa Rica and Panama. Since the publication of a monograph of *Chamaedorea* (Hodel, 1992a) and subsequent articles adding several new species (Hodel, 1992b, 1995, 1996; Hodel et al., 1995), further study has enabled me to name and describe two new species.

Chamaedorea ponderosa Hodel, sp. nov. TYPE: Panama. Darién: Cerro Pirre, 2–3 mi. N of summit, 7°56′N, 77°42′W, 1000–1100 m, 31 Dec. 1978, *Hartman 8529* (pistillate) (holotype, MO 3233713).

Subgeneris *Chamaedoreae* (Martius) H. A. Wendland. *C. murriensi* Galeano affinis sed habitu grandiore, foliis nervis pluribus, inflorescentiis rhachidibus longioribus, petalis et sepalis nervis valde prominentibus, floribus masculinis dense positis, fructibus aurantiacis differt.

Solitary, slender, understory palmlet to 2–4 m tall. Stem 2–2.5 cm diam., ringed, internodes 4–5 cm. Leaves simple and bifid, sometimes irregularly pinnate then usually with large terminal lobes and smaller basal pinnae, drying dark olive-green with a heavy, thick, bulky appearance; leaf base 25–30 cm long, obliquely long-open apically, tubular in basal 20–25 cm, longitudinally striated with a raised costa extending from petiole for 5–8 cm; petiole 18–35 cm long, 6–8 mm diam. at apex, 8–10 mm diam. at base, rounded and lighter green abaxially, flattened but becoming channeled toward base adaxially, longitudinally striated; rachis 40–50 cm long in simple blades, 40–60 cm long in pinnate blades, rounded and lighter green abaxially, angled and lighter green adaxially; simple blades 75 × 45–50 cm, incised apically 25 cm, acute-acuminate, with 20 elevated, sharply angled, primary nerves adaxially, these elevated abaxially, spaced 2 cm apart, 2–3 secondaries between each pair of primaries, secondaries not too conspicuous adaxially, 1–2 tertiary nerves abaxially between each pair of secondaries or a secondary and a primary, nerves of lesser orders numerous, faint, all nerves lighter colored and except for primaries more conspicuous abaxially; pinnate blades 80–90 × 45–50 cm, pinnae 2–8(–16) per side, terminal pair to 30–45 × 10–15 cm, basal pinnae 30–45 × 2.5–5.5 cm, sigmoid, falcate, long-acuminate, variously nerved depending on width but in same pattern as above. Inflorescences 50–75 cm long; peduncle 40–55 cm long, 1–1.5 cm wide at base, 3–5 mm diam. at apex; bracts 5–7, prophyll 2–4 cm long, 2nd bract 10 cm long, 3rd 25 cm long, 4th 35 cm long, 5th 15 cm long and exceeding peduncle and concealing a smaller 6th bract to 5 cm long, bracts brown in flower, becoming tattered in fruit, obliquely open apically, longitudinally striated, basal bracts acute-acuminate, apical ones long-acuminate; rachis 12–17 cm long; staminate rachillae 9–31, these 25–40 cm long, 1–1.5 mm diam., drooping; pistillate rachillae 13–28, mostly simple but a few basal ones furcate, 18–25 cm long, 1.5–2 mm diam., ± spreading, peduncle and rachillae orange in fruit. Staminate flowers in ± dense spirals 2–3 mm apart, ± superficial, leaving elliptic scars 1.25–1.5 mm long, flowers in bud 2 × 2–2.75 mm; calyx 1 × 2–2.75 mm, deeply lobed ⅔ to base, prominently nerved, sepals connate in basal ⅓, broadly rounded apically, acute; petals 2 × 1.75–2 mm, ovate, valvate, acute, connate briefly basally and apically and there adnate to pistillode, corolla opening by lateral slits, prominently nerved; stamens 6, anthers 1 mm long, dorsifixed near base, filaments 0.5 mm long; pistillode 1.5 mm tall, columnar. Pistillate flowers in lax spirals 4–10 mm apart, ± superficial, leaving elliptic scars 1.75 mm long; flowers just past anthesis 2 × 3 mm; calyx 1 × 3 mm, cupular, moderately lobed, prominently nerved, sepals imbricate and/or connate in basal ½, broadly rounded apically; petals 2.5 × 3 mm, broadly obovate-spatulate, prominently nerved, imbricate in basal ¾, rounded apically; pistil 2 × 2.5

mm, globose, styles lacking, stigmas short, angled, recurved. Fruits 8 × 7 mm, subglobose, orange.

The epithet is from the Latin *ponderosus*, meaning weighty or heavy, and is used here in reference to the thick, bulky, heavy-looking inflorescences and mostly simple leaf blades. *Chamaedorea ponderosa* is closest to *C. murriensis* Galeano, but the latter differs in its smaller habit, fewer primary foliar nerves, shorter and smaller flowering and fruiting rachises, laxly placed staminate flowers, nerveless (or barely so) sepals and petals, and brown fruits. *Chamaedorea ponderosa* is to be expected in adjacent portions of Colombia; one collection, *Gentry et al. 28690*, is from "cloud forest exactly on the Panama/Colombia border."

Paratypes. PANAMA. **Darién:** Camp Summit between Morti and Sasardi, 600 m, 6–7 Mar. 1967, *Duke 10681* (sterile) (MO); Cerro Pirre, ridgetop near Rancho Plástico, 10–20 July 1977, 1200 m, *Folsom 4296* (pistillate) (MO); 1000–1400 m, 29 Dec. 1972, *Gentry 7037* (staminate) (BH, MO); Alto de Nique, 1300–1520 m, 19 Apr. 1980, *Gentry et al. 28690* (pistillate) (MO); SE of summit, 7°56′N, 77°42′W, 1400 m, 14 July 1977, *Hartman et al. 4590* (staminate) (MO); SW of summit, 7°56′N, 77°42′W, 1300 m, 15 July 1977, *Hartman et al. 4801* (staminate) (MO); N slopes, 700–950 m, 6 Apr. 1976, *Mori et al. 5452* (pistillate) (MO).

Chamaedorea christinae Hodel sp. nov. TYPE: Colombia. Valle del Cauca: Río Naya upriver from Puerto Merizalde, 10 m, 3°15′N, 77°25′W, very wet lowland forest, 23 Feb. 1983, *Gentry et al. 40692* (pistillate) (holotype, MO 3301445, 3301446, 3301447; isotype, COL).

Species insignis inflorescentiis infrafoliaribus pauciramosibus, rachillis rectis rigidis parallelis, vaginis et petiolis et rhachidibus viridibus, floribus femineis flavis ad aurantiacis, foliis pinnatis, a ceteris speciebus bene distincta.

Solitary, slender, understory palmlet to 4 m tall. Stem 2.5 cm diam., green, prominently ringed, internodes 5–6 cm. Leaves 5; sheath open nearly to base, clasping for less than ½ its length, free in apical 20 cm and there similar to petiole; petiole to 29 cm long, 7–10 mm diam., cylindrical; rachis ca. 130 cm long; 13 pinnae on each side, middle pinnae 50 × 8 cm, apical pinnae 24–26 × 3–4 cm, all lanceolate, acuminate, slightly sigmoid, contracted basally to 1.5 cm wide, subopposite, spaced 9 cm apart at point of attachment, horizontally disposed, papery, drying dark green, with 6–7 primary nerves adaxially, these green, the middle one most prominent, one secondary between each pair of primaries, tertiaries numerous, faint, primaries and secondaries yellowish abaxially. Staminate inflorescence and flowers not seen. Pistillate inflorescences infrafoliar; base and some of lower portion of peduncle not seen, remaining portion to 50 cm long, 4 mm wide at apex, longitudinally striated, green in flower, orange to red where exposed in fruit; only distal 3 bracts present but a 4th scar visible, incomplete proximal bract 12 cm long, acute, 2nd bract 17 cm long, bifid, acuminate, 3rd and most distal bract 3 cm long, mostly concealed by 2nd one, all bracts thick-papery, brownish, longitudinally striated; rachis to 3.5–5 cm long, green in flower, orange in fruit; rachillae 3–5(–6?), to 26 cm long, 2.5 mm diam., ± stiff, straight, parallel (at least in flower), diverging from rachis at obtuse angle, green in flower, orange in fruit, longitudinally striated when dry. Pistillate flowers in moderate to lax spirals 2–4 mm apart, only slightly sunken, leaving elliptic scars 3 mm long; 3.5 × 3.5 mm, ± ovoid; calyx cupular, 2.5 × 3 mm, moderately to deeply lobed with age, sepals connate and/or imbricate in basal ½ to ⅛, ± thin especially along brown margins, tips broadly rounded but incurved between petals, greenish, few white nerves adaxially; petals 3.5 × 2.5 mm, long-ovate, valvate, free nearly to base, ± cupped, acute, ± thin, yellow (to orange?) with few fine white nerves adaxially; staminodes small, toothlike, thin, whitish; pistil 2.5 mm × 2–2.5 mm, ovoid, green, stigma lobes ± deeply parted, flattened, recurved. Fruits immature, 1.5 × 1 cm, obovoid-globose, green, stigmatic remains subbasal.

Chamaedorea christinae is known only from the type, a collection of the late Alwyn H. Gentry consisting of three sheets, and one other collection. Although staminate material of *C. christinae* was not seen, the large, yellow pistillate flowers and dark green pinnae with prominent, light colored nerves suggest subgenus *Morenia* or *Moreniopsis*. The three currently recognized species of subgenus *Morenia*, *C. linearis* (Ruiz & Pavón) Martius, *C. latisecta* (H. E. Moore) A. H. Gentry, and *C. smithii* A. H. Gentry are amply distinct, however, in their pyramidal, generally much more ramified pistillate inflorescences with more than three times as many drooping, curved rachillae branching at nearly right angles from the rachis. *Chamaedorea linearis* and *C. smithii* also differ in their shorter, much more shallowly lobed pistillate calyx. Of the two species in subgenus *Moreniopsis*, *C. angustisecta* Burret differs in its distinctly mottled sheath, petiole, and rachis, more numerous narrow pinnae, and much longer pistillate inflorescence with many more curved rachillae and smaller flowers. The other member of subgenus *Moreniopsis*, *C. pauciflora*

Martius, differs in its interfoliar, spicate pistillate inflorescences with smaller flowers. Even if staminate material is collected which shows *C. christinae* to be in another subgenus, the combination of characters included in the protologue is sufficient to distinguish it from all other species in the genus.

The epithet honors my daughter, Christina H. Hodel, who has accompanied me on several field expeditions to Latin America and who has the uncanny, admirable talent of always finding the greatest of pleasures in the simplest of things.

Paratype. COLOMBIA. **Valle del Cauca:** Costa del Pacifico, Río Naya, Calle Larga, between Puerto Merizalde and San Francisco, 100 m, 3 Feb. 1990, *Bernal et al. 1755* (pistillate) (COL, TULV).

Acknowledgments. I thank Rodrigo Bernal and Gloria Galeano, who located an isotype of *Chamaedorea christinae* at COL and brought the one known paratype to my attention; Wilson Devia of TULV, who sent the paratype on loan for study; B. Juan Chahinian and Michael H. Grayum, who reviewed the manuscript and offered valuable suggestions; and the Missouri Botanical Garden for lending specimens.

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Some Clarifications, New Species, and New Combinations in American Cynanchinae (Asclepiadaceae)

Sigrid Liede
Abteilung Spezielle Botanik, Universität Ulm, 89069 Ulm, Germany

Ulrich Meve
Institut für Botanik, Westf. Wilhelms-Universität Münster, Schloßgarten 3, 48149 Münster, Germany

ABSTRACT. Two new species of *Cynanchum* in South America are described, *C. bifidum* Liede & Meve and *C. trollii* Liede & Meve. One South American *Cynanchum* species is transferred to *Oxypetalum*, fourteen to *Metastelma*, and four to *Ditassa*. *Stelmatocodon* and *Fontellaea* are recognized as synonyms of *Philibertia*.

The enormous variety of American Cynanchinae has puzzled even experienced specialists of the family. The difficulties presented by the often minute flowers and narrowly endemic ranges of the species are aggravated by the often insufficient descriptions without illustrations. While a thorough revision of *Cynanchum* and its relatives for the entire continent is not feasible at the moment, several new additions and clarifications are possible as a result of a long-term project of the first author.

MATERIALS AND METHODS

The holdings of A, AAU, B, BM, CTES, G, GA, GB, L, LIL, LPB, M, MO, MPU, P, S, SGO, SI, UC, and USZ have been studied. Dried material was supplemented by our own collections of living and spirit material from Argentina, Bolivia, Chile, Mexico, and the United States. For corona terminology, Liede and Kunze (1993) have been followed; for clarification of gynostegium structures, see Liede (1996).

NEW SPECIES

Cynanchum bifidum Liede & Meve, sp. nov. TYPE: Ecuador. Azuay: 1–2 km N of Nieves, Ceja forest, 3000–3100 m, 16 Nov. 1988, *Harling 25919* (holotype, GB). Figure 1.

C. intricato similis, sed differt in lobis coronae staminalis profunde bifidis.

Plants ascending, twining, 3–4 m high, richly branched, at least basally following a dichasially branching pattern. Shoots perennial, herbaceous, densely covered with flexuous trichomes, 0.7–0.8 mm long; internodes 15–50 cm long. *Leaves* estipulate, with 1–2-mm-long petiole, 2 colleters at the base of the leaves; leaf blades herbaceous, 8–10 × 3–5 mm, ovate, basally rounded, apically acute, entirely glabrous. *Inflorescences* always one per node, extra-axillary, sessile, 4–10-flowered, all flowers open synchronously, sciadioidal. Floral bracts ca. 0.7 × 0.3 mm, ovate, glabrous; pedicels 1–2 mm long, glabrous. Buds ca. 2.2 × 1.2 mm, globose, with imbricate aestivation. *Calyx* basally fused, abaxially glabrous, lobes ca. 1.2 × 0.5 mm, ovate, acute. *Corolla* cyathiform, basally fused, abaxially and adaxially greenish white, purple along the main nerves, glabrous; lobes 2.5–3 × 1–1.2 mm, oblong, apically obtuse, incurved. *Corona* gynostegial, white, 1.2–1.5 mm high, equaling the gynostegium in height, consisting of staminal and interstaminal parts just basally fused, staminal lobes laminar, deeply bifid, apically erect. *Gynostegium* ca. 0.8 × 0.8 mm, atop a stipe, ca. 0.6 mm long. Anthers about as high as broad, pentagonal, abaxially convex; anther wings 0.35 mm long, not extending along the whole length of the anther, consisting of a distal and a proximal ridge; adjacent anther wings parallel to each other, basally widened, in the same plane as the anther. Connective appendages 0.35–0.4 × 0.25–0.3 mm, ovate, narrower than the stamen, slightly inflexed. *Pollinarium*: corpusculum ca. 0.18 mm long, almost twice as long as broad, elliptical; caudicles ca. 0.075 mm long, cylindrical, straight, horizontal; pollinia apically attached to the caudicles, ca. 0.275 × 0.1 mm, ovoid, ovate in cross section. *Stylar head* ca. 0.5 mm diam., 0.375 mm high; upper part 0.125 mm high, tabular. *Fruits*, *seeds*, and *chromosome number* unknown.

This new species belongs in the *C. microphyllum* Kunth group, which is particularly diverse in the northeastern Andes. It is probably most closely re-

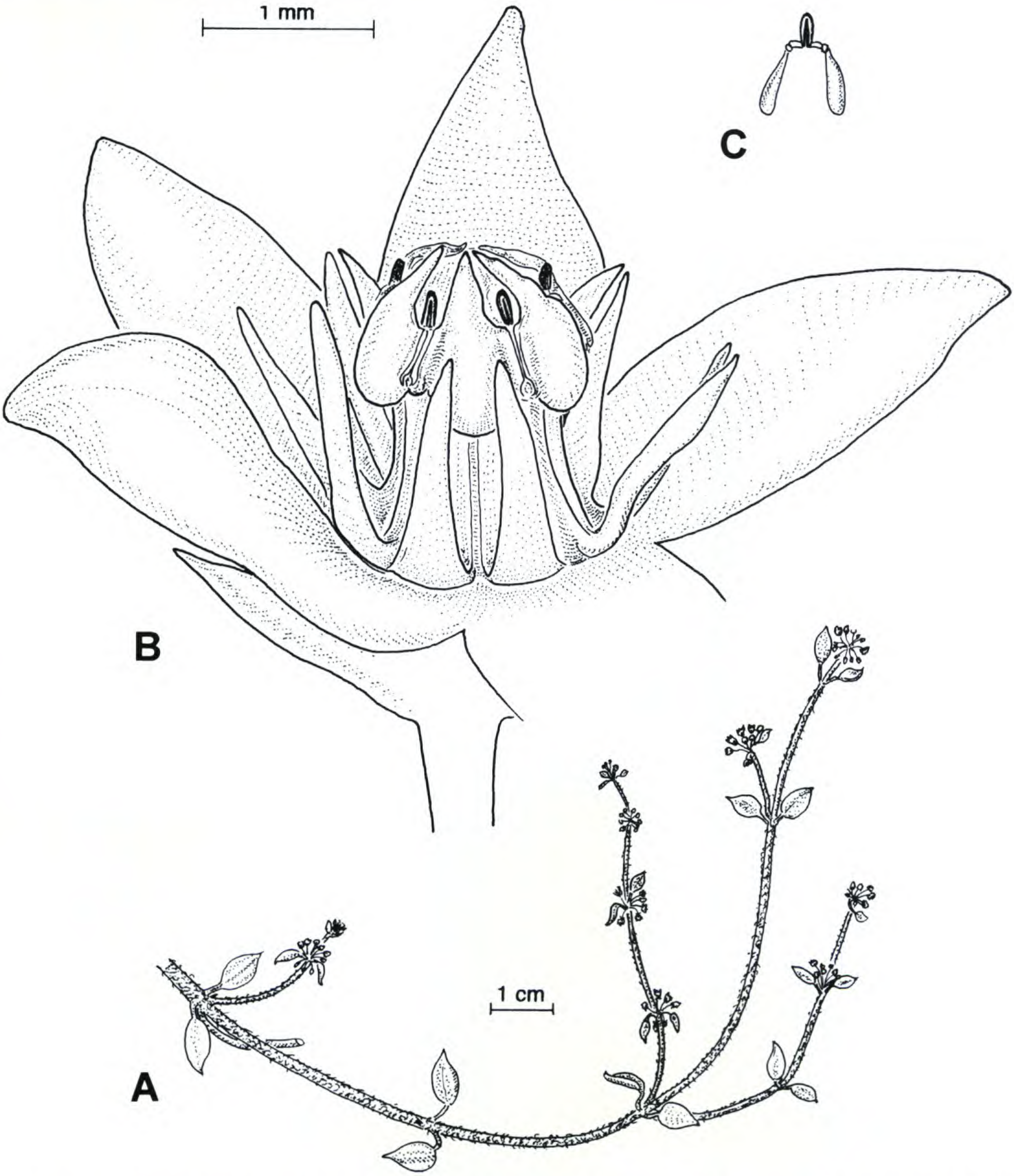

Figure 1. *Cynanchum bifidum* Liede & Meve. —A. Habit. —B. Flower. —C. Pollinarium. (From *Harling 25919*, GB; drawn by U. Meve.)

lated to *C. intricatum* K. Schumann from the Pichincha area in Ecuador, but is clearly different by the deeply bifid corona lobes and the stronger dichasial branching pattern.

Cynanchum trollii Liede & Meve, sp. nov. TYPE: Bolivia. Cañanema: Río de la Pax, 1260 m, dry forest, 18 Mar. 1928, *Troll 1675* (holotype, M). Figure 2.

Herba scandens, foliis cordatis, inflorescentibus racemiformibus, corolla pubescenti, sed corona corollae inserta.

Plants ascending, twining. Shoots perennial, herbaceous, densely covered with erect trichomes, ca. 0.25 mm long, arranged along a single line. Internodes 12–17 cm long. *"Stipules"* 5–10 mm long, ca. 6 mm wide, ovate. *Leaves* on a 10–40-mm-long petiole, 3 colleters at the base of

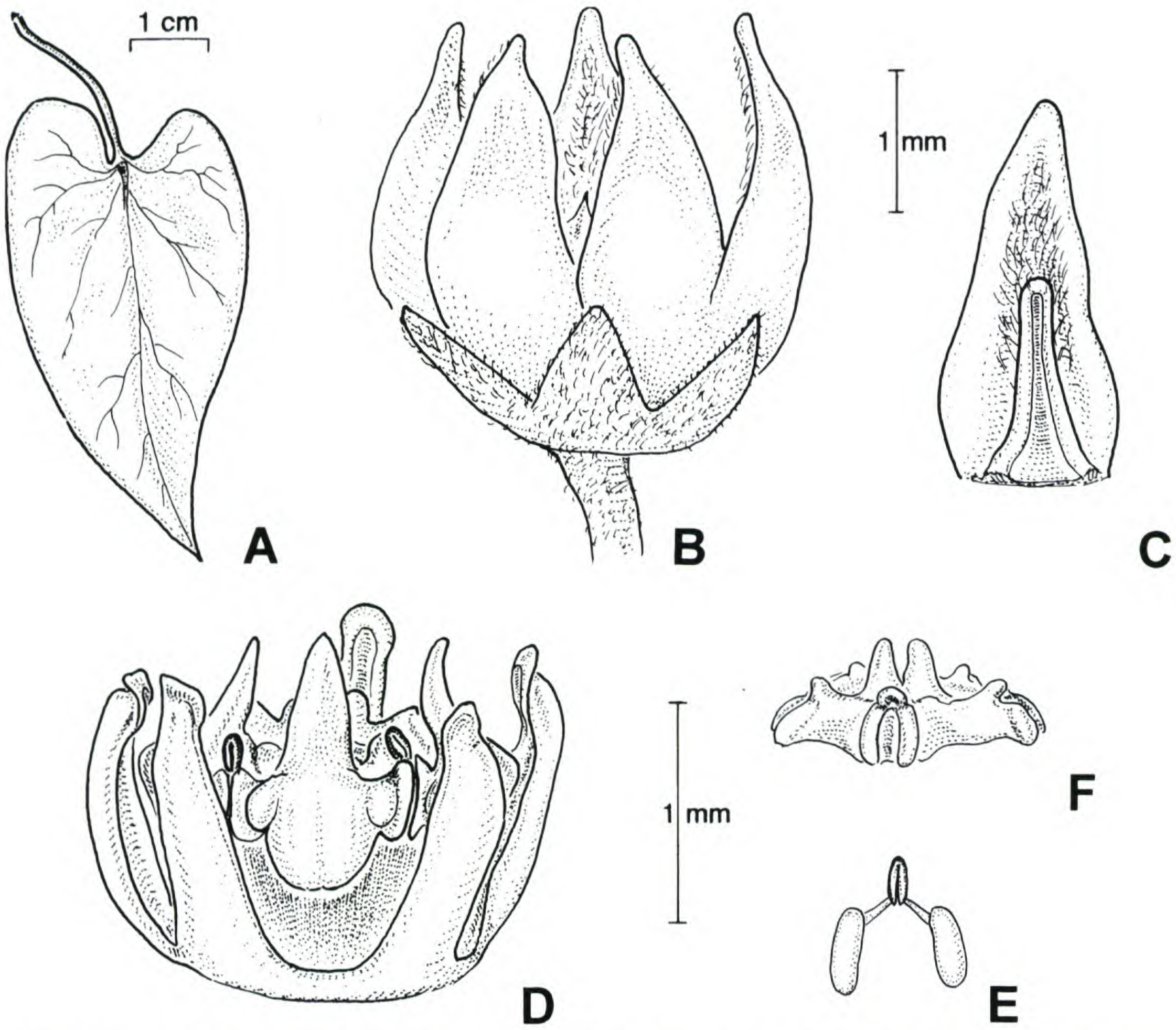

Figure 2. *Cynanchum trollii* Liede & Meve. —A. Leaf. —B. Flower. —C. Adaxial side of corolla lobe with corona lobe inserted. —D. Gynostegium with corona. —E. Pollinarium. —F. Stylar head. (From *Troll 1675*, M; drawn by U. Meve.)

the leaves; leaf blades herbaceous, 40–55 × 20–35 mm, ovate, basally lobate; lobes 5–7 mm long, apically acute, adaxially and abaxially almost glabrous. *Inflorescences* frondulose, 15–20-flowered, 4–6 flowers open at the same time, bostrychoid, basally with one or two bifurcations; partial inflorescences geminiflorous; peduncles 0–12 mm long, densely covered with flexuous trichomes, 0.2–0.3 mm long, arranged along a single line; rachis 8–15 mm long, angular. Floral bracts 0.5–1 × 0.25–0.5 mm, triangular. Pedicels 2–4 mm long, densely covered with flexuous, 0.1–0.15-mm-long trichomes arranged along a single line. Buds ca. 2 × 2 mm, globose, with imbricate aestivation. *Calyx* basally fused, abaxially with trichomes, lobes ca. 1.5 × 0.75 mm, ovate, apically obtuse. *Corolla* cyathiform, basally fused; lobes ca. 1.7 × 1 mm, oblong, apically obtuse, incurved, abaxially with trichomes, adaxially with ca. 0.25-mm-long trichomes, concentrated on the apical and lateral parts. *Corona* corolline, oppositisepalous, ca. 1.3 mm high, shorter than the corolla, lobes laterally connate, laminar, rounded (slightly cucullate), erect, with straight margins, glabrous. *Gynostegium* ca. 1.7 × 1.4 mm, atop a stipe, ca. 0.5 mm long. Anthers broader than high, rectangular, abaxially convex; anther wings ca. 0.35 mm long, not extending along the whole length of the anther; consisting of a distal and a proximal ridge with space between distal and proximal ridge glabrous; adjacent anther wings parallel to each other. Connective appendages ca. 0.6 × 0.3 mm, ovate, narrower than the stamen, erect. *Pollinarium*: corpusculum ca. 0.2 mm long, almost twice as long as broad, elliptical; caudicles ca. 0.15 mm

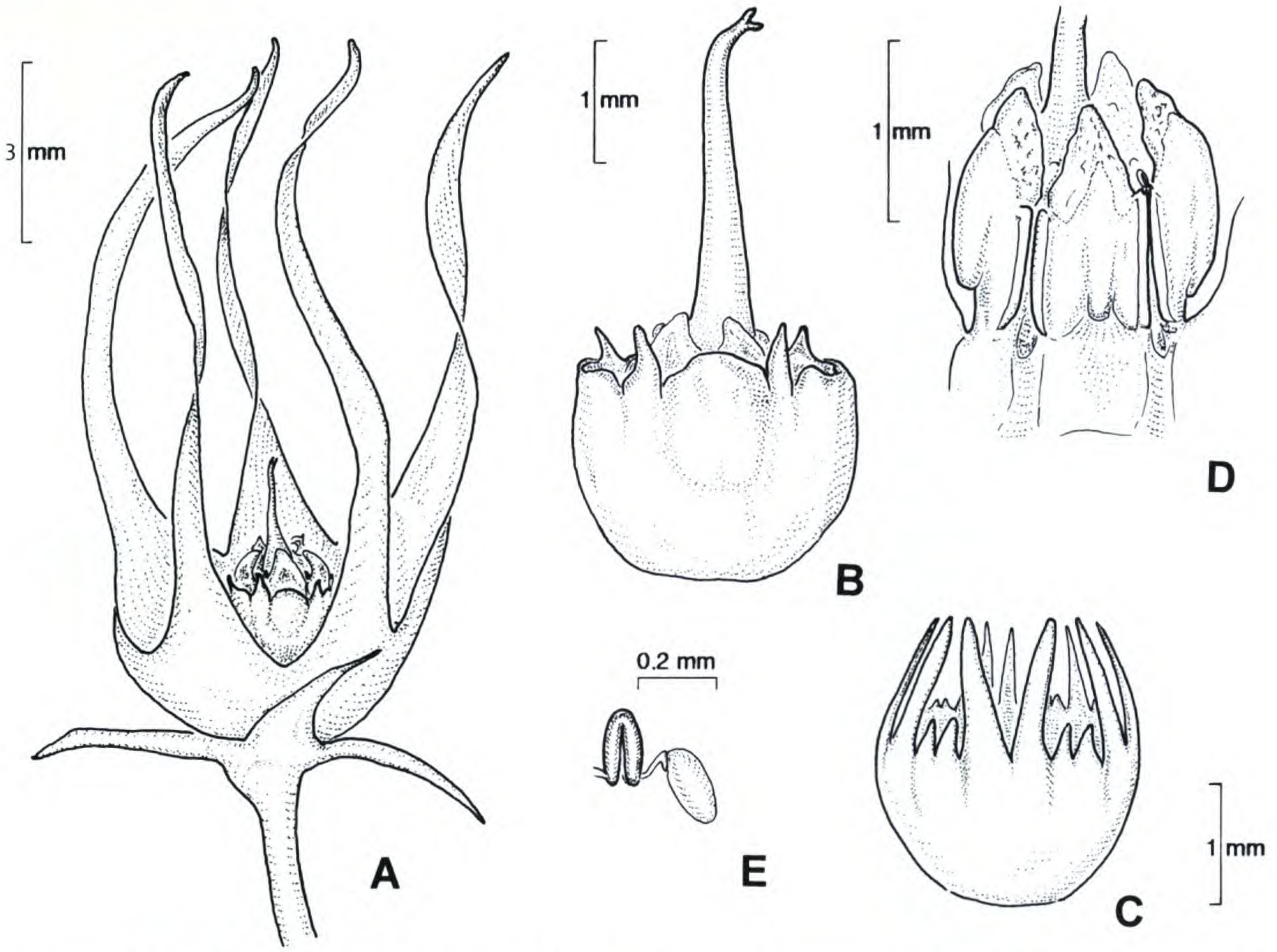

Figure 3. *Oxypetalum streptanthum* (Malme) Liede & Rua. —A. Flower. —B. Gynostegium with corona. —C. Corona. —D. Gynostegium. —E. Pollinarium. (A, B, D, E from *I. Holmgren 950*, S; C from *Hensen 887*, USZ; drawn by U. Meve.)

long, cylindrical, concavely recurved; pollinia subapically attached to the caudicles, ca. 0.4 × 0.125 mm, ovoid, ovate in cross section. *Stylar head* ca. 1.25 mm diam., 0.55 mm high; upper part ca. 0.25 mm high, bifurcate. *Fruits, seeds,* and *chromosome number* unknown.

In all other *Cynanchum* species known to us, the insertion point of the corona is situated exactly at the point of union of the gynostegium (filament tube) and the corolla, and is derived structurally from the gynostegium (e.g., Kunze, 1982). In *C. trollii*, the attachment has shifted clearly toward the corolla. In asclepiad taxonomy, corona insertion is usually regarded as a genus-defining character. However, as it seems unwise to describe a new genus on such scanty material, the preliminary inclusion of *C. trollii* in *Cynanchum* seems adequate, since it fits the concept of the genus in all other characters. The lack of fruits prevents an answer to the question of whether the species is more closely related to subgenus *Mellichampia* Sundell (forming one follicle per flower) or to the *C. formosanum* N. E. Brown group of species (invariably forming two follicles per flower).

New Combinations

Oxypetalum streptanthum (Malme) Liede & Rua, comb. nov. Basionym: *Cynanchum streptanthum* Malme, Ark. Bot. 25A(7): 8. 1933. TYPE: Ecuador. Pichincha: Machachu, 2800 m, 12 Nov. 1920, *I. Holmgren 950* (holotype, S). Figure 3.

Extension of known range: BOLIVIA. **Cochabamba:** Quillacollo, Chorojo, 3600 m, 28 Aug. 1990, *Hensen 887* (USZ); Arque, Sihuyalla, 3300 m, 5 Jan. 1992, *Ibisch 832* (LPB).

Malme's (1933) excellent description needs no update. He mentioned that the name written on the specimen was *Oxypetalum*, but described it under *Cynanchum* because caudicular appendages were lacking. However, in one subgenus of *Oxypetalum*, subg. *Cryptodus* (E. Fournier) T. Meyer, caudicular

appendages are small or absent. The species shares with *Oxypetalum* subg. *Cryptodus* the twisted corolla lobes, long stylar head, and very erect twinned follicles, all features absent from other American members of *Cynanchum*.

METASTELMA R. BROWN

One of the most unfortunate decisions in the history of American *Cynanchum* was the inclusion of *Metastelma* within the genus (Woodson, 1941). Based on his experience of North American material only, Woodson did not appreciate the differences between *Cynanchum* and *Metastelma* as sufficient for generic recognition. *Cynanchum* is easily recognized by its gynostegial corona of fused staminal and interstaminal parts and its corolla lobes, which are either entirely glabrous or possess a few sparse, short, erect, verrucose trichomes on the adaxial side. *Metastelma*, in contrast, possesses a gynostegial corona that consists only of staminal parts and a densely bearded corolla. Leaf shape, which is invariably linear in *Metastelma*, and inflorescence structure, which is invariably sciadioidal (denoting an umbelliform inflorescence derived from a dichasial one; see also Liede & Weberling, 1995) in *Metastelma*, though helpful in the field, do not constitute useful generic characters, because both characters are highly plastic in *Cynanchum*. Of the North American species with linear leaves, most conform to the concept of *Metastelma* (*M. barbigerum* Scheele, *M. blodgetti* A. Gray, *M. californicum* Bentham, *M. latifolium* Rose, *M. minutiflorum* Wiggins, *M. northropiae* Schlechter, *M. palmeri* S. Watson, *M. pringlei* A. Gray, *M. watsonianum* Standley). However, *Cynanchum angustifolium* Persoon and a few related species (Liede, 1997), despite linear leaves and sciadioidal inflorescences, show entirely glabrous corolla lobes and a ring-shaped corona of fused staminal and interstaminal parts and cannot be included in *Metastelma* according to this concept.

His ignorance of South American material further prevented Woodson (1941) from recognizing the close similarities between *Metastelma* and *Ditassa* R. Brown, which is different only in possessing a second staminal corona lobe and most likely constitutes the sister genus of *Metastelma*. As most South American workers have rather uncritically adopted Woodson's concept, several new combinations are necessary to clarify the concept of *Cynanchum* in the Americas.

Metastelma chimantense (Morillo) Liede, comb. nov. Basionym: *Cynanchum chimantense* Morillo, Ernstia 4: 5. 1981. TYPE: Venezuela. Bolívar: Chimantá massif, 2000–2150 m, *J. Steyermark 75813* (holotype, VEN).

Metastelma eulaxiflorum (Lundell) Liede, comb. nov. Basionym: *Cynanchum eulaxiflorum* Lundell, Wrightia 5(9): 351. 1977. TYPE: Guatemala. Dept. Baja Verapaz: Union Barrios, E of km 154, 8 June 1975, *Lundell & Contreras 19401* (holotype, LL).

Metastelma exasperatum (R. W. Holm) Liede, comb. nov. Basionym: *Cynanchum exasperatum* R. W. Holm, Fieldiana 28: 507. 1953. TYPE: Venezuela. Mérida: Quebrada of Cuesta del Barro, 2530–2715 m, 11 May 1944, *J. Steyermark 56474* (holotype, SGO; isotype, MO).

Metastelma hirtellum (Oliver) Liede, comb. nov. Basionym: *Vincetoxicum hirtellum* Oliver, Timehri 5: 199. 1886. *Cynanchum hirtellum* (Oliver) Badillo in Pittier et al., Cat. Fl. Venez. 2: 312. 1947. TYPE: Venezuela. Roraima: *Im Turm 144* (holotype, F; isotype, MO).

Cynanchum revolutum R. W. Holm, Fieldiana 28(3): 508. 1953. TYPE: Venezuela. Bolívar: vicinity of "Misia Kathy camp" on mesa between Ptari-Tepui and Sororopan-Tepui, *Steyermark 60236* (holotype, F; isotype, MO). Synonym: Morillo, Ernstia 37: 6. 1986.

Metastelma huberi (Morillo) Liede, comb. nov. Basionym: *Cynanchum huberi* Morillo, Ernstia 4: 7. 1981. TYPE: Venezuela. Territorio Federal Amazonas: Dept. Atabapo, alrededores de Canaripó, 98 m, *O. Huber 1867* (holotype, VEN; isotype, MY).

Metastelma liesnerianum (L. O. Williams) Liede, comb. nov. Basionym: *Cynanchum liesneriana* L. O. Williams, Fieldiana 34: 102. 1972. TYPE: Costa Rica. Guanacaste: vicinity of Cañas, 12 Dec. 1969, *Daubenmire 406* (holotype, F).

Metastelma longicoronatum (L. O. Williams) Liede, comb. nov. Basionym: *Cynanchum longicoronatum* L. O. Williams, Fieldiana 32: 37. 1968. TYPE: Mexico. Chiapas: 3 km S of La Trinitaria, 1700 m, 14 Oct. 1965, *Breedlove & Raven 13199* (holotype, F; isotype, DS).

Metastelma nubicola (Morillo) Liede, comb. nov. Basionym: *Cynanchum nubicola* Morillo, Ernstia 2: 8. 1992. TYPE: Venezuela. Trujillo. Carache: carretera Carache–La Peña, 31.5 km E de Carache, 2000–2200 m, 28 Sep. 1988, *Morillo 10543* (holotype, VEN; isotype, MERF).

Metastelma ovalifolium (A. Richard) Liede, comb. nov. Basionym: *Astephanus ovalifolius* A. Richard in Sagra, Hist. Fis. Cuba, Bot. 95. 1855. TYPE: Cuba. Prope Santiago, *Linden 1847* (lectotype, designated here, P).

Metastelma paraquense (Morillo) Liede, comb. nov. Basionym: *Cynanchum paraquense* Morillo, Ernstia 4: 12. 1981. TYPE: Venezuela. Territorio Federal Amazonas: Cerro Paraque (Sipapo), 1600–1800 m, Feb. 1946, *K. Phelps 38* (holotype, VEN).

Metastelma pubipetalum (Alain) Liede, comb. nov. Basionym: *Cynanchum pubipetalum* Alain, Mem. Soc. Cubana Hist. Nat. 22: 118. 1955, new name for *Astephanus cubensis* Kunth in Humboldt & Bonpland, Nov. Gen. Sp. 3: 206. 1818. TYPE: Cuba. Prope Regla, *Bonpland 5277* (lectotype, designated here, P).

Additional material seen. CUBA. 1861, *C. Wright 1665* (G, det. Alain, 1955)

Metastelma quitense (K. Schumann) Liede, comb. nov. Basionym: *Cynanchum quitense* K. Schumann, Bot. Jahrb. Syst. 25: 728. 1898. SYNTYPES: Ecuador. Prope Quito, Dec. 1895, *Sodiro 107/16* and ad montem Chimborazo in declivibus ad Pallatango, *Sodiro 107/17* (syntypes, both presumably QPLS). Figure 4.

Additional material seen. ECUADOR. **Pichincha:** Vía mitad Mudo-Calacalí, 12 July 1950, *Rambo 47275* (AAU); Vía mitad Mudo-Calacalí, 7 Apr. 1979, *Jaramillo & Silva 920* (AAU); Pichincha, 2800 m, 16 Apr. 1920, *Holmgren 533* (G); Riobamba, NE of Riobamba, 2800 m, 17 Feb. 1934, *Schimpff 726* (M); prope Riobamba, *Sodiro s.n.* (G).

Material annotated by K. Schumann was traced in G (*Sodiro s.n.*, prope Riobamba), and so was the specimen on which Malme's (1933) amplified description was based (*I. Holmgren 533*, G). The species is slightly problematical because it possesses rather flat corona lobes, which seem basally fused in the poorly pressed *Sodiro* specimen. However, the better preserved *Holmgren* specimen shows that

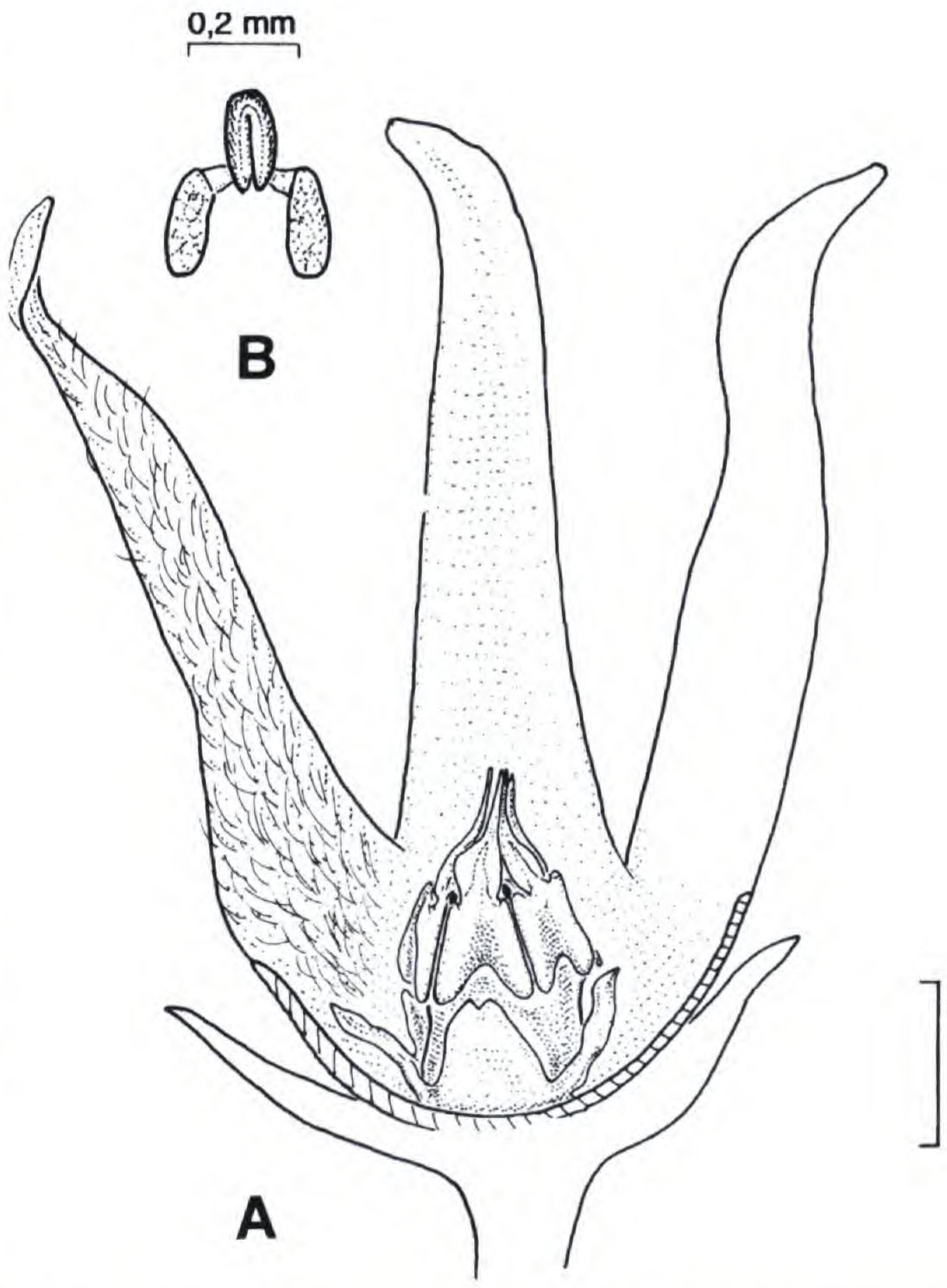

Figure 4. *Metastelma quitense* (K. Schumann) Liede. —A. Flower. —B. Pollinarium. (From *Jaramillo & Silva 920*, AAU; drawn by U. Meve.)

the corolla lobes, though flat, are fused to the gynostegium, but not to each other. In addition, the long-barbate corolla, which is more than twice as long as the gynostegium, fully corresponds with the concept of *Metastelma*.

Metastelma spruceanum (Morillo) Liede, comb. nov. Basionym: *Cynanchum spruceanum* Morillo, Ernstia 2: 64. 1992. TYPE: Ecuador. Andes. 1857–59, *Spruce 5995* (holotype, G). Figure 5.

Metastelma stipitatum (Correll) Liede, comb. nov. Basionym: *Cynanchum stipitatum* Correll, J. Arnold Arbor. 58: 44. 1977. TYPE: Bahamas. North Caicos: Bottle Creek Airstrip, 3 Sep. 1974, *D. S. Correll 43436* (holotype, A).

Two additional species are almost certainly members of *Metastelma*; however, no authentic material could be traced and the descriptions are not provided with drawings: *Cynanchum beatricis* Morillo, *Cynanchum manarae* Morillo (Morillo, 1978).

DITASSA R. BROWN

The genus *Ditassa* has never seriously been claimed to constitute part of *Cynanchum*. However,

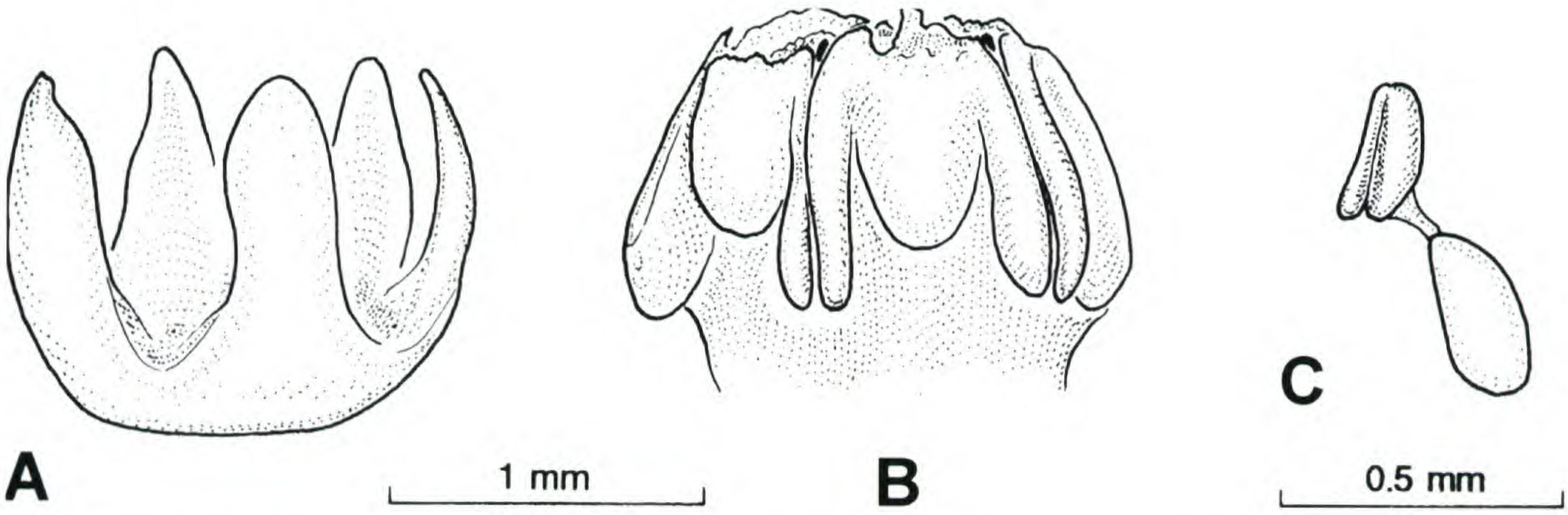

Figure 5. *Metastelma spruceanum* (Morillo) Liede. —A. Corona. —B. Gynostegium. —C. Pollinarium. (From *Spruce 5995*, G; drawn by U. Meve.)

in his early works, Morillo (e.g., 1981) did not recognize *Ditassa*. While most species have been transferred (e.g., Morillo, 1989), a few are still erroneously included in *Cynanchum*.

Ditassa buntingii (Morillo) Liede, comb. nov. Basionym: *Cynanchum buntingii* Morillo, Ernstia 51: 2. 1989. TYPE: Venezuela. Territorio Federal Amazonas: 11 km E de Maroa, 125 m, *Steyermark & Bunting 102 813* (holotype, VEN).

Additional material seen. VENEZUELA. **Amazonas:** 1 km E of Maroa, Río Guaínía, 120–140 m, 25 Nov. 1953, *Maguire, Wurdack & Bunting 36410* (MO).

Ditassa franciscoi (Morillo) Liede, comb. nov. Basionym: *Cynanchum franciscoi* Morillo, Ernstia 51: 3. 1989. TYPE: Venezuela. Territorio Federal Amazonas: Dept. Rio Negro, Norte de Serrania de Unturan, 300–350 m, *Guanchez 860* (holotype, VEN; isotype, TFA).

Additional material seen. VENEZUELA. Amazonia, 35 km S of Samariapo, towards Río Sipapo, 26 June 1975, *Gentry & Berry 14622* (MO).

Ditassa jahnii (Morillo) Liede, comb. nov. Basionym: *Cynanchum jahnii* Morillo, Ernstia 2: 7. 1992. TYPE: Venezuela. Mérida: Mucurubá, 2600–2700 m, 3 July 1930, *Gehriger 289* (holotype, VEN; isotype, G).

Ditassa sobradoi (Morillo) Liede, comb. nov. Basionym: *Cynanchum sobradoi* Morillo, Ernstia 4: 13. 1981. TYPE: Venezuela. Territorio Federal Amazonas: 2 km NE de San Carlos de Río Negro, *Morillo, Morillo & Wood 3895* (holotype, VEN).

It is very possible that *Cynanchum leptostephanum* Diels from Ecuador, of which the holotype was destroyed in B and no isotypes were found, also constitutes a species of *Ditassa*.

PHILIBERTIA KUNTH

In the course of the present study, an isotype of *Stelmatodocon fiebrigii* Schlechter was found in M. The specimen can clearly be attributed to the genus *Philibertia* Kunth, so this monotypic genus can be placed in synonymy of *Philibertia*. This material corresponds to the plant recently published as *Fontellaea boliviana* Morillo (Morillo, 1994), the only species of the genus *Fontellaea* Morillo. Thus, *Fontellaea* Morillo constitutes a further synonym of *Philibertia*.

Philibertia fiebrigii (Schlechter) Liede, comb. nov. Basionym: *Stelmatodocon fiebrigii* Schlechter, Bot. Jahrb. Syst. 37: 618. 1906. TYPE: Bolivia. Soledad prope San Luis, 1500 m, Jan. 1904, *Fiebrig 2678* (lectotype, designated here, M).

Fontellaea boliviana Morillo, Anales Jard. Bot. Madrid 52(1): 36. 1994. Syn. nov. TYPE: Bolivia. La Paz: Quime, small town about 100 mi. from Oruro, 16 Mar. 1949, *W. Brooke 5295* (holotype, BM).

Additional material seen. BOLIVIA. **La Paz:** Larecaja, on the trail between Laripata and Sorata, 3000 m, 14 Mar. 1979, *Keel 463* (LPB); Sorata, 14 km hacia Quiabaya, 2970–3000 m, Mar., *Beck 1346* (LPB).

Acknowledgments. Thanks are due to the directors of the institutions listed in Materials and Methods for long-term loans of specimens. The DFG has financially supported the asclepiad work of SL (grants LI 496/1-4), including a field trip to South America. Gabriel Hugo Rua, Argentinian botanist, is collaborating with SL on Argentinian Asclepiadaceae and is the coauthor of the new combination in *Oxypetalum*.

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New Taxa, a New Name, and a New Combination in Rubiaceae from Southern Mexico and Mesoamerica

David H. Lorence
National Tropical Botanical Garden, P.O. Box 340, Lawai, Hawaii 96765, U.S.A.

ABSTRACT. Six new species of Rubiaceae from southern Mexico and Mesoamerica are described and illustrated: *Crusea andersoniorum* Lorence, *Deppea miahuatlanica* Lorence, *Glossostipula strigosa* Lorence, *Hedyotis terrellii* Lorence, *Rondeletia evansii* Lorence, and *Rondeletia pringlei* Lorence. One new combination is proposed, *Chomelia rudis* (Standley) Lorence, based on *Anisomeris rudis* Standley, and the new name *Psychotria molinarum* Lorence is proposed based on *Evea chiapensis* Standley.

During the course of preparing the Rubiaceae treatment for *Flora Mesoamericana*, collections representing undescribed taxa in various genera from Mesoamerica and southern Mexico were encountered. A number of these specimens were collected during field explorations of botanically poorly known areas for the *Flora Mesoamericana*, *Flora of Chiapas*, and *Flora de Oaxaca* projects. Six new species are described and illustrated and their affinities discussed. In addition, one new combination is made and one new name is proposed. The taxa are arranged here alphabetically by tribe and within each tribe following Andersson (1992). A complete account of the Mesoamerican Rubiaceae will be given in the forthcoming treatment for *Flora Mesoamericana* by D. Lorence, C. M. Taylor, and other contributors.

GARDENIEAE

Glossostipula strigosa Lorence, sp. nov. TYPE: Honduras. Atlántida: base of N slope of Pico Bonito, E of new CURLA (Centro Universitario Regional del Litoral Atlántico) camp building on Quebrada Grande, ca. ⅓ km above its confluence with the Río Bonito, ca. 10 km SW of La Ceiba, Parque Nacional Pico Bonito, 15°42′N, 86°51′W, 140 m, 8 May 1993, *R. Evans 1559* (holotype, MO 04585952 (photo PTBG); isotype, PTBG 16114). Figure 1.

Species *Glossostipulae concinnae* (Standley) Lorence affinis, sed ramunculis foliis inflorescentia strigosa ex trichomatibus 0.2–1 mm longis constanti, folia acuminata, acumine 1–1.5 cm longo saepe falcato differt.

Understory tree 6 m tall, leafy twigs 1.5–3 mm diam., densely fulvous-strigose with stiff, simple, ascending hairs 0.2–1 mm long, pubescence persistent, internodes 0.7–6 cm long. Leaves opposite, short-petiolate, those of a pair equal or subequal; petioles 4–8 × 1–1.2 mm, densely strigose; lamina oblanceolate, 6.3–14.8 × 2.1–5 cm, chartaceous, adaxially sparsely strigose, hairs denser along costa, abaxially densely strigose along costa and veins, the surface strigose-hirtellous, base acute or narrowly cuneate, apex acuminate, the acumen 1–1.5 cm long, often falcate, secondary veins 7–12 pairs, festooned brochidodromous, venation visible to 4° or 5° on both surfaces, the margin ciliate; stipules intrapetiolar, 10–13 × 3–4.5 mm, foliaceous, oblong-elliptic, rounded at apex, externally strigose, internally glabrous, deciduous leaving ring of brown colleters 1 mm long at node. Staminate inflorescences terminal, pleiochasial, 15–18-flowered, sessile or peduncle to 2 mm long, with 3–5 densely strigose primary branches 5–6 mm long, subtended by 1–2 pairs of stipule-like bracts. Staminate flowers on densely strigose, minutely bracteolate pedicels 3–7 × 0.8 mm, hypanthium small, the calycine cup broadly campanulate, 2–2.5 × 3–4 mm, externally densely strigose, internally glabrous, the calyx 5–6-lobed or undulate, the calyx lobes broadly triangular or subcircular, 0.5–1 × 1–1.5 mm, strigose, the apex acute to obtuse or retuse; corolla white, traced with light yellow when fresh, shortly hypocrateriform at anthesis, the tube 6–7 mm long, 2 mm wide medially, externally densely strigose, internally glabrous, the lobes 6, spreading, 5–6 × 4 mm, obovate-ligulate, the apex rounded to truncate, the external margin ciliolate; stamens 6, sessile, basifixed, the anthers linear, 3–3.5 × 0.7–0.9 mm, exserted and recurved, the apex apiculate, the base truncate; style 8–9 mm, strigose medially, stigma 2 mm long, clavate, exserted, weakly 4-lobed. Pistillate inflorescence and fruit not seen.

Distribution. Known only from the type locality in lowland primary tropical wet forest at

Figure 1. *Glossostipula strigosa* Lorence. —a. Habit, staminate flowering branch. —b. Staminate corolla, opened. —c. Style from staminate flower. All from *Evans 1559*. Bars = 1 cm in a, 15 mm in b, 12 mm in c.

140 m elevation in the Atlántida Department of Honduras.

Although pistillate flowers and fruit have not been seen, this staminate collection is clearly referable to *Glossostipula* based on the following combination of characters: foliaceous intrapetiolar stipules; dioecy; distinctive pleiochasial inflorescences with dichasial branches; 6-merous flowers; 4-lobed stigma; and tricolporate pollen. This new species is most closely allied to *Glossostipula concinna* (Standley) Lorence, a cloud forest species occurring at 1200–2800 m and ranging from southern Mexico to Honduras. *Glossostipula concinna* differs by its glabrous stems and inflorescence axes, glabrous leaves with acute to obtuse or rounded apices, presence of pit domatia in the secondary vein axils, and cloud forest habitat. The third member of the genus, *G. blepharophylla* (Standley) Lorence, restricted to *Quercus* forest in the Sierra Madre Occidental of western Mexico, differs by its sessile or subsessile leaves with ciliate margins and spreading, rufous-villous pubescence (Lorence, 1986).

GUETTARDEAE

Chomelia rudis (Standley) Lorence, comb. nov. Based on *Anisomeris rudis* Standley, Field Mus. Nat. Hist., Bot. Ser. 17: 394. 1938. TYPE: Honduras. Comayagua: in forest near the summit of the ridge above El Achote, in cloud zone, above the plains of Siguatepeque, 1800 m, 1 Aug. 1936, *G. T. Yuncker, R. F. Dawson & H. R. Youse 6253* (holotype, F 857678 (photo PTBG); isotype, MO 1115471).

Traditionally *Anisomeris* K. Presl and *Chomelia* Jacquin had been separated on the basis of the former genus having unappendaged corolla lobes and anthers with obtuse basal lobes versus the latter genus having corolla lobes with external corniculate appendages near the apex and anthers with sagittate basal lobes. Steyermark (1967) discussed the inconsistency of these characters and recommended combining the two genera under *Chomelia*, making 20 new combinations. Steyermark's view has been followed by authors of most recent floristic treatments (e.g., Andersson, 1992; Burger & Taylor, 1993; Dwyer, 1980). Although the type of *Anisomeris rudis* lacks corollas, it otherwise corresponds with *Chomelia* in other morphological characters, and the new combination is here proposed. Among its Mesoamerican congeners, *C. rudis* is distinguished by its leaf blades having both the tertiary and quaternary veins subparallel, and the smallest (quaternary) veins are also subparallel within the tertiary vein areoles. This character is shared with *Chomelia venulosa* W. C. Burger & C. M. Taylor from Costa Rica (Burger & Taylor, 1993), which differs from *C. rudis* by its appressed strigulose pubescence, twice-dichotomous inflorescences, and ovate-obtuse calyx lobes.

HAMELIEAE

Deppea miahuatlanica Lorence, sp. nov. TYPE: Mexico. Oaxaca: Distrito de Miahuatlán, Municipio de San Jerónimo Coatlán, 17.9 Km al SO de San Jerónimo Coatlán, carretera Miahuatlán–Piedra Larga, 1800 m, 16°12′N, 96°57′W, 13 dic. 1987, *R. Torres C. & A. Campos 10847* (holotype, PTBG 15197; isotype, MEXU). Figure 2.

Species *Deppeae schultzei* Lorence affinis, sed corolla longiore hypocrateriforme, corollae tubo 30–35 mm longo, extus glabro differt.

Shrub 2–4 m tall, the twigs terete or slightly compressed, often bisulcate, 1.5–2.5 mm diam., finely and sparsely strigillose when young, glabrescent, the internodes 2–3.5 cm long. Leaves opposite, petiolate, those of a pair unequal, one up to twice as large as the other; petioles 4–35 × 0.6–1.2 mm, finely strigillose when young, adaxially sulcate; lamina elliptic, narrowly elliptic, or ovate-elliptic, 4.5–17 × 1.5–5 cm, chartaceous, slightly discolorous, drying brownish green, adaxially minutely strigillose when young, glabrate, abaxially sparsely strigillose along costa and secondary veins, the base acute, narrowly cuneate, or attenuate, the apex short acuminate, the acumen 5–20 mm long, often falcate, the secondary veins 6–10 pairs, festooned brochidodromous, arcuate, rarely with pit domatia beneath, the ultimate venation reticulate, visible to 3°–4° adaxially, visible to 5° abaxially, the margin plane; stipules interpetiolar, broadly triangular to obtuse, 0.7–1 × 0.5–1.5 mm, thick, externally puberulent, persistent, margin with 6–8 short, brown, digitate colleters. Inflorescence terminal, dichasial, corymbiform, 7–8 × 3–4 cm, trichotomous, branching to 3°, the flowers 10–20(–50), the peduncle 20–23 mm long, the primary branches 6–10 mm long, these branching up to three times, the secondary branches 2–4 mm long, the ultimate branches ending in monochasial cymules of 3–7 flowers, the axes finely strigillose-hirtellous, with minute, triangular bracteoles 0.2–0.3 mm long; flowers 4-merous, on minutely strigillose pedicels 2.5–4 mm long, the hypanthium turbinate, minutely strigillose-hirtellous, 1.5 × 1.2–1.5 mm, the calyx cup 0.5 mm deep, the calyx lobes triangular, subequal, 0.4–1 × 0.4–0.8 mm, strigillose; corolla orange when fresh, drying dark reddish orange, at anthesis hypocrateriform, glabrous externally, the tube 30–35 mm long, 3 mm wide medially, 4 mm wide distally, the lobes contorted in bud, erect-spreading at anthesis, 3–3.5 × 2–2.5 mm, ovate-elliptic, glabrous, acute at apex; stamens attached near apex of tube, the tips exserted 4 mm, the anthers 5–5.5 mm long, the apex acute, the base sagittate, the filaments 2 mm long; style 32 mm long, the 2 stigma lobes 4 mm long, oblong. Capsules obovoid, 5.5–8 × 3.5–5 mm, glabrous, bisulcate, weakly to moderately 6–8-costate, the base rounded, the apex obtuse with protruding disc. Seeds angulate, 0.4–0.5 mm long, the testa dark brown, foveolate-reticulate.

Distribution. Known only from the Sierra de Miahuatlán in southern Oaxaca, a part of the Sierra Madre del Sur.

Habitat. Montane *Pinus-Quercus* forest with elements of cloud forest, growing in yellowish sandy soil, 1800–1900 m elevation. Collected in flower in December and in fruit in May and August. Collec-

Figure 2. *Deppea miahuatlanica* Lorence. —a. Habit, flowering branch. —b. Flower. —c. Infructescence. —d. Mature capsule. a, b, *Torres C. & Campos 10847;* c, d, *Campos V. & Cortés 2260.* Bars = 1 cm in a, b, c, 6 mm in d.

tors' notes indicate this species is frequent to abundant locally.

Deppea Chamisso & Schlechtendal is a genus of 25 species centered in central and southern Mexico and adjacent Guatemala (Lorence & Dwyer, 1988). On the basis of its orange, hypocrateriform corollas *D. miahuatlanica* is closely allied to *D. schultzei* Lorence from the Sierra Madre del Sur of Guerrero, which differs in having a shorter corolla tube 10–13 mm long and leaves with vein axils consistently barbate beneath. *Deppea miahuatlanica* also resembles *D. grandiflora* Schlechtendal in vegetative and fruiting characters, but the latter species is distinguished by its smaller capsules 2–5 mm long

Figure 3. *Hedyotis terrellii* Lorence. —a. Habit, top of plant and detail of node. —b. Habit, base of plant. —c. Pistil. —d. Corolla, opened. —e. Capsule. a, b, e, *Torres C. & Martínez 9067;* c, d, *Torres C. & Téllez 8643.* Bars = 1 cm in a, b, 5 mm in c, 6 mm in d, 2 mm in e.

and 2–4 mm in diameter and much smaller, shortly funnelform or rotate corollas.

Paratypes. MEXICO. **Oaxaca:** Distrito de Miahuatlán, Municipio de San Jerónimo Coatlán, 17.9 km al SW de San Jerónimo Coatlán, brecha a Piedra Larga, 16°12′N, 96°58′W, 1890 m, 17 May 1988, *Campos V. 1841* (MEXU, PTBG), *1852* (MEXU, PTBG), 19.2 km al SW de San Jerónimo Coatlán, 1900 m, 13 ago. 1988, *Campos V. & Cortés 2260* (MEXU, PTBG); 9.6 km al

SE del Cerro de Vidrio, carretera Oaxaca–Puerto Escondido, 1850 m, 1 ago. 1984, *Torres C. & Martínez 5826* (MEXU, PTBG).

HEDYOTIDEAE

Hedyotis terrellii Lorence, sp. nov. TYPE: Mexico. Oaxaca: Distrito de Mixe, Municipio de Totontepec, 3 km al SO de Totontepec, carretera a Mitla, 1910 m, bosque mesófilo, 6 sep. 1986, *R. Torres C. & C. Martínez 9067* (holotype, PTBG 12314; isotype, MEXU). Figure 3.

Species *Hedyoti kingii* (Terrell) Nesom affinis, sed inflorescentia maiore 7–15 cm longa, 6–15 cm lata, floribus cum pedicellis longioris 7–25 mm longis, lobis calycinis minoribus subaequalibus, ovato-triangularibus vel lanceolato-ellipticis, 1–2 mm longis, 0.4–0.6 mm latis, corolla extus glabra differt.

Herb 45–80 cm tall, presumably perennial, branching from the base with several erect stems 2.5–3.5 mm diam. toward base, terete, glabrous, smooth, yellowish brown, distally compressed and bisulcate; leaves opposite, short-petiolate, those of a pair equal; petioles 3.5–5 × 1–1.5 mm, narrowly winged, adaxially grooved, glabrous; lamina elliptic to ovate-elliptic, (2.5–)4.5–10 × (1–)1.5–4 cm, the base acute, often decurrent, the apex short-acuminate, the acumen 1–1.5 cm long, glabrous, chartaceous, drying drab green or brownish green, the secondary veins 3–6 pairs, arcuate, camptodromous, prominent, the 3° venation forming a prominent, oblique, intersecondary reticulum and a distinct intramarginal vein, the margin thin, translucent, with minute serrulations when young; stipules persistent, interpetiolar, united with the petiole bases, the body triangular, 1–2 × 3–4 mm, the acuminate apex 3–3.5 mm long, the apex and margin with filiform, glandular-tipped appendages 1–2 mm long. Inflorescences terminal, compound cymes 7–15 × 6–15 cm, subtended by reduced leaves, branching dichasially to 2° or 3°, the primary branches 2–5 cm long, the axes slender, glabrous, subtended by stipule-like bracts; flowers 4-merous, on filiform pedicels 7–25 × 0.1 mm, in fruit to 32 mm long; hypanthium broadly obconic, 0.5–0.8 × 1–1.3 mm, glabrous, the calyx cup 0.2 mm deep, the calyx lobes subequal, ovate-triangular to lanceolate-elliptic, 1–2 × 0.4–0.6 mm, glabrous; corolla in bud quadrangular, rounded at apex, at anthesis campanulate, the tube 2–2.5 × 2.5–3 mm, both surfaces glabrous, the lobes erect or slightly spreading, elliptic, 3–4 × 1.5–1.7 mm, acute at apex, externally glabrous, internally villosulous with crinkled, white trichomes; stamens attached near middle of tube below sinuses, the filaments 0.5 mm long, the anthers linear-elliptic, 1 mm long; style 2–2.5 mm, the 2 stigma lobes linear, 1 mm long. Capsule hemispherical-depressed, 2–3 × 3–4 mm, ½ inferior, thin-walled; seeds [immature] few, ca. 6 per capsule, 1–1.2 × 0.5–0.8 mm, dorsally convex and irregularly wrinkled, ventrally angulate, testa blackish brown, shiny, foveolate.

Distribution. Known only from the type locality near Totontepec in the mountainous Mixe District of Oaxaca.

Habitat. Cloud forest at ca. 1900 m elevation. Collected in flower in March, and in flower and fruit in June and September.

This new species is most closely allied to *Hedyotis kingii* (Terrell) Nesom from Oaxaca, which differs by its shorter stipule appendages 0.3–0.5 mm long, smaller inflorescences 8–9 × 6–7 cm, and flowers with shorter pedicels 3–8 mm long, longer lance-linear calyx lobes 2–4.7 × 0.4–0.8 mm, and corollas which are externally glabrous and internally glabrous or puberulent. *Hedyotis terrellii* is also allied to *H. galeottii* (M. Martens) Terrell & Lorence from Veracruz and Oaxaca, which differs by its densely hirtellous stems and inflorescence axes, smaller leaves 2.5–6 × 0.8–3 cm, shorter stipule appendages 0.2–0.3 mm long, smaller inflorescences 3–5 × 2–5 cm, and flowers with shorter pedicels 1–4 mm long and funnelform corolla that is externally hirtellous or glabrous and internally short villous with a tube 3 mm long (Terrell & Lorence, 1989). Unfortunately, mature seeds of *H. terrellii* were not available for comparison with other species. I am pleased to name this species for E. E. Terrell, whose studies of the Hedyotideae have contributed to our understanding of this tribe.

Paratypes. MEXICO. **Oaxaca:** Distrito Ixtlán, Llano Verde, collector unknown, *Herb. Reichbach fils III-396* (W); Distrito Mixe, Municipio de Totontepec, Totontepec, bosque mesófilo de montaña, 1900 m, 17°15′N, 96°02′W, 11 mar. 1990, *Rivera R. & Martin 1403* (PTBG, UC); 2 km al SO de Totontepec, carretera a Oaxaca, 1900 m, 17 jun. 1986, *Torres C. & Téllez 8643* (MEXU, PTBG (also flowers preserved in alcohol)).

PSYCHOTRIEAE

Psychotria molinarum Lorence, nom. nov. Based on *Evea chiapensis* Standley, Contr. U.S. Natl. Herb. 23: 1392. 1926. *Cephaëlis chiapensis* (Standley) Standley, Publ. Field Mus. Nat. Hist., Bot. Ser. 4: 295. 1929, not *Psychotria chiapensis* Standley, 1926. TYPE: Mexico. Chiapas: Cerro del Boquerón, *C. A. Purpus 6928* (holotype, US 567214 (photos MEXU, PTBG); isotypes, F, MO (photos MEXU, PTBG)).

It is now generally agreed that *Cephaëlis* Swartz (including *Evea* Aublet) is an unnatural, polyphyletic assemblage, and that most species described in these genera are referable to the large genus *Psychotria* L.

(Steyermark, 1972; Hamilton, 1989; Taylor et al., 1991; Taylor & Lorence, 1992; Burger & Taylor, 1993). Examination of the species described as *Evea (Cephaëlis) chiapensis*, which ranges from Chiapas to Jalisco in Mexico's Sierra Madre del Sur, shows it is clearly referable to *Psychotria* subg. *Heteropsychotria* Steyermark, thus necessitating a new name for this taxon.

Psychotria molinarum is allied to the group of neotropical species of *Psychotria* subg. *Heteropsychotria* with flowers in pedunculate, bracteate capitula, including *P. ostreophora* (Wernham) C. M. Taylor from western South America and Panama (Taylor, 1994). *Psychotria molinarum* differs from *P. ostreophora* in having much shorter stipule sheaths 0.5–0.7 mm long, stipule awns 2.5–5 mm long attached to outside base of the sheath, a larger inflorescence 15–20 mm long with eight flowers enclosed by four pairs of broadly ovate (outer) to narrowly ovate (inner) bracts 11.5–16 × 4.5–12 mm, acute or acuminate at the apex and subcordate at the base, and flowers with small, triangular calyx teeth 0.1–0.2 mm long and thin white corollas with a tube 9–10 mm long.

I am pleased to name this species for Antonio Molina R., former Curator of the Escuela Agrícola Panamericana (EAP) herbarium, and his wife, Albertina R. de Molina, for their valuable contributions to our knowledge of the Honduran flora and tropical American Rubiaceae.

RONDELETIEAE

Rondeletia evansii Lorence, sp. nov. TYPE: Honduras. Lempira: Parque Nacional de Celaque, sendero entre la planta eléctrica y la primera casa abandonada de Don Tómas, 14°36′N, 88°40′W, 1800 m, 28 jan. 1992, *P. House 1163* (holotype, PTBG 16112; isotypes, EAP not seen, HEH not seen, MO, TEFH not seen). Figure 4.

Species *Rondeletiae laniflorae* Bentham affinis, sed inflorescentia breviori magis compacta 4–10 cm longa, 2.5–5 cm lata, floribus cum lobis calycinis obovato-ellipiticis (1–)2–4 mm longis, 1.2–2.2 mm latis differt.

Shrub or small tree to 5 m tall, the twigs 2–3 mm diam., when young densely arachnoid tomentose, the trichomes pale brownish white, matted, the internodes 0.6–4 cm long. Leaves opposite, those of a pair subequal to unequal, one 2–3 times larger than the other, shortly petiolate; petioles 2–20 × 0.7–1.5 mm, densely arachnoid-tomentose; lamina elliptic or obovate elliptic, (1.3–)3–16 × (0.7–)1.5–5.3 cm, subcoriaceous, strongly discolorous, adaxially drying dark brown, sparsely flocculose-tomentose when young, glabrescent, abaxially densely and persistently pale brownish white, arachnoid-tomentose, the base acute or narrowly cuneate, the apex acute or obtuse, rarely rounded or short acuminate with the tip 2–5 mm long, the secondary veins 7–11 pairs, straight then arching near margin, camptodromous or weakly festooned brochidodromous, sunken and visible to 5° adaxially, visible to 3° abaxially, the margin slightly revolute; stipules interpetiolar, erect, stiff, 5–8 × 2.5–3 mm, the base triangular, the apex subulate-acuminate, externally arachnoid tomentose. Inflorescence terminal, 25–60(–75)-flowered, 4–10 × 2.5–5 cm (including corollas), compact, subcapitate- or thyrsiform-cymose, shorter than or sometimes equaling the subtending leaves, the peduncle 1.5–4 cm long, the primary branches 2–4 pairs, 2–5 mm long, each subtended by a bract 5–10 × 1–2 mm and ending in compact 6–7-flowered dichasia, the axes densely pale brownish white, arachnoid-tomentose; flowers distylous, 4-merous, subsessile or the pedicels to 1.5 mm long, each subtended by a ligulate bracteole 2–3 mm long; hypanthium ovoid, 1–1.5 × 1–1.5 mm, densely tomentose, the calyx cup 0.5 mm deep, pilose within, the calyx lobes erect-spreading, foliaceous, venose, obovate-elliptic, subequal or unequal, 2–4 × 1.2–2.2 mm, externally densely tomentose, internally flocculose-pilosulous, each sinus with a brown colleter; corolla pink when fresh, hypocrateriform at anthesis, the tube 8–14 × 0.8–1 mm medially, externally densely arachnoid tomentose, internally retrorsely pilose in basal ⅓, the lobes 4, spreading 90°, subcircular-obovate, 2–3 × 1.5–2.5 mm, obtuse, the margins undulate or crisped, externally tomentose basally, internally glabrous; stamens sessile, the anthers ellipsoid, 1.5–2 × 0.4–0.5 mm, in short-styled flowers attached 1 mm below apex of tube with tips exserted, in long-styled flowers attached 2.5 mm below apex of tube, included; style glabrous, in short-styled flowers 6 mm long, the 2 stigmas 1–1.5 mm long, in long-styled flowers 14–15 mm long, the 2 stigmas 0.5 mm long, the disc glabrous. Capsules broadly ovoid, 4–6 × 4–6 mm, compressed, bisulcate, arachnoid-tomentose, dehiscence at first loculicidal, then septicidal; seeds 0.5–0.6 mm diam., angulate, testa dark brown, deeply foveolate-reticulate.

Distribution. Known only from the Montaña de Celaque area (Parque Nacional de Celaque) in the Departamento de Lempira, Honduras.

Habitat. Primary and secondary montane wet forest and cloud forest from 2100 to 2540 m elevation. Flowers (said to be odorless, *Thomas 65*) have been collected in January, February, and November and fruits in November.

Rondeletia evansii is most closely allied to *R. laniflora* Bentham, which ranges from Chiapas to Guatemala and El Salvador, and also to the widespread

Figure 4. *Rondeletia evansii* Lorence. —a. Habit, flowering branch. —b. Short-styled flower, tube cut away. —c, d. Long-styled flower, opened corolla and style. —e. Dehisced capsule. —f. Seed. a, c, d, *House 1163;* b, *Evans 1188;* e, f, *Hazlett 2288.* Bars = 1 cm in a, 16 mm in b, 15 mm in c, d, 8 mm in e, 1 mm in f.

and variable *R. buddleioides* Bentham, which ranges from Mexico to Panama. *Rondeletia evansii* differs from these two species in its more compact and condensed, subcapitate-cymose or thyrsiform-cymose inflorescences usually shorter than the subtending leaf pair (although inflorescences in the type are somewhat larger) and larger, obovate-elliptic, foliaceous calyx lobes 2–4 × 1.2–2.2 mm. This new species has been confused with *R. nebulosa* Standley from Honduras, which has, in addition to a white tomentum, numerous long, reddish brown hairs on the stems, leaves, and inflorescence axes and a longer inflorescence exceeding the subtending leaves. I am pleased to name this new species for Randall J. Evans, whose excellent collections have contributed to our knowledge of the flora of Honduras.

Paratypes. HONDURAS. **Lempira:** Celaque National Park, six year old secondary vegetation of guamil surrounding the Don Tómas campsite, 14°32′N, 88°40′W, 2320 m, 11 Nov. 1991, *Thomas 65* (MO, PTBG); along trail from Camp

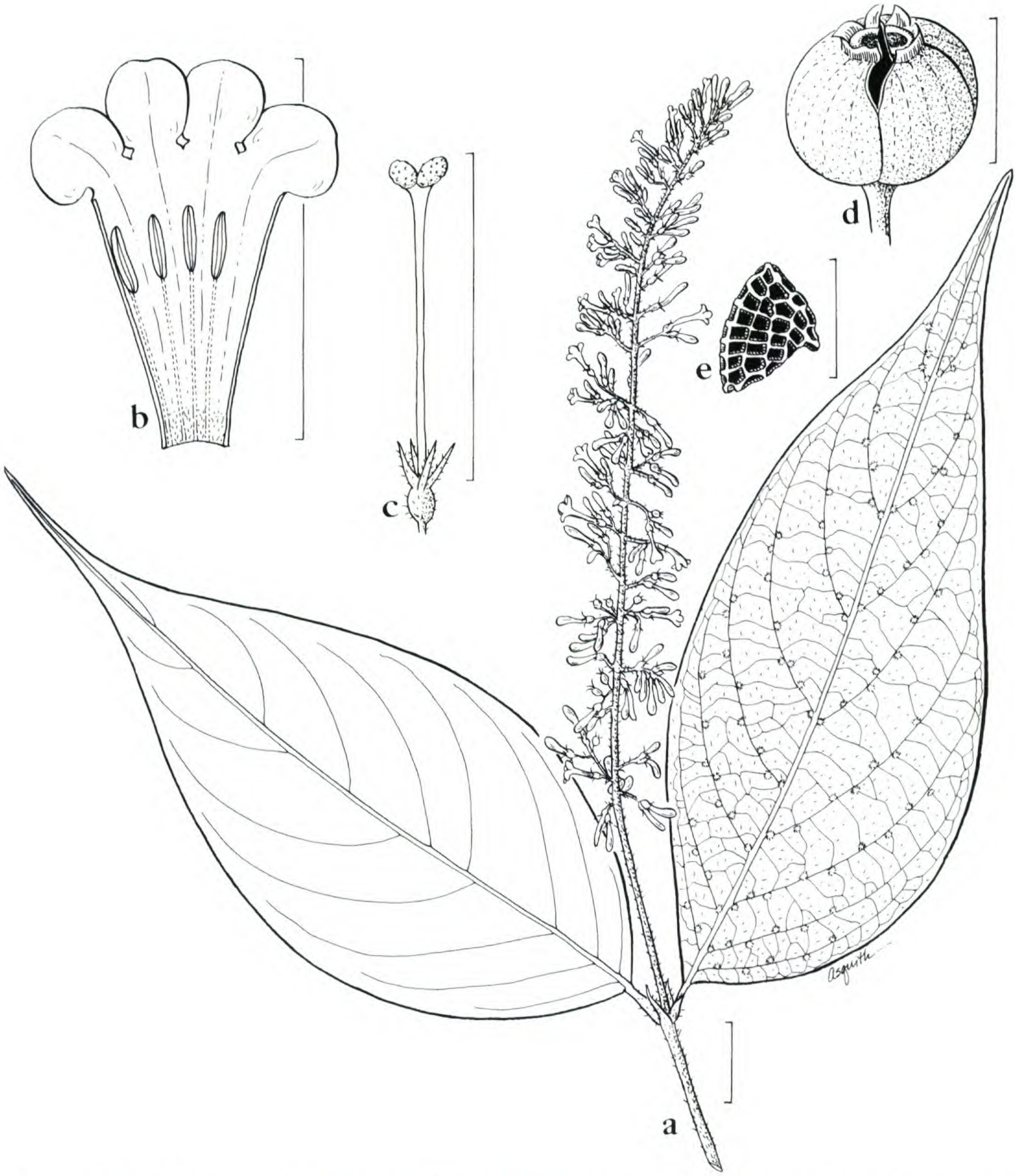

Figure 5. *Rondeletia pringlei* Lorence. —a. Habit, flowering branch. —b, c. Opened corolla and pistil of long-styled flower. —d. Dehiscing capsule. —e. Seed. a–c, *Gutierrez B. 2872;* d, e, *Lorence & Ramamoorthy 4296.* Bars = 1 cm in a, 7 mm in b, 6 mm in c, 2.5 mm in d, 0.5 mm in e.

Don Tomás to Camp Naranjo, near Camp Naranjo, ca. 10 km WSW of Gracias, Parque Nacional Celaque, 14°33′N, 88°40′W, 2540 m, 12 Feb. 1993, *Evans 1188* (MO, PTBG); Montaña de Celaque, arriba del Planta Electrica, 2100 m, 18–22 Nov. 1974, *Hazlett 2288* (MO).

Rondeletia pringlei Lorence, sp. nov. TYPE: Mexico. Veracruz: hills near Orizaba, 5000 ft., 9 Feb. 1895, *C. G. Pringle 6135* (holotype, GH; isotypes, K, MEXU, MO, WU). Figure 5.

Species *Rondeletiae capitellatae* Hemsley affinis, sed ramunculis foliisque sparsim strigosis ex trichotomatibus 0.2–0.5 mm longis constanti, floribus cum lobis calycinis subaequalibus, 0.2–1.2 × 0.1–0.2 mm, triangularibus vel linearisubulatis, tubo corollino 4–5 mm longo extus sparse strigilloso, corolla lobis sparse strigillosis, capsula minoribus 2.5–3.5 mm diametro differt.

Shrub or treelet 1.5–3 m tall, the young twigs strigillose, the trichomes white or fulvous, 0.2–0.5 mm

long, the leafy twigs terete, 1–1.5 mm diam., brown, persistently strigillose, the internodes 2–5 cm long. Leaves opposite, those of a pair equal or subequal, petiolate; petioles 1.5–5 × 0.6–1 mm, strigillose; lamina elliptic, narrowly elliptic, or ovate-elliptic, 4.5–12 × 1.5–6.2 cm, chartaceous, drying brown or brownish green, slightly discolorous, adaxially with scattered hairs, at least along costa and veins, or glabrous, abaxially strigillose-hirtellous, the hairs denser along the costa, veins, and margin, the base narrowly cuneate to acute, obtuse, or rounded, often slightly decurrent, the apex short to long acuminate, often falcate, the acumen 0.7–2 cm long, the secondary veins 5–8 pairs, camptodromous, the 2° and 3° vein axils barbate, the venation visible to 3° adaxially and to 4° abaxially, the margin thin; stipules interpetiolar, subulate, 2–4.5 mm long, 0.5–1 mm wide basally, brown, externally strigillose, rigid, erect, persistent. Inflorescence terminal and solitary, narrowly thyrsoid- or spiciform-cymose, 6–13 × 1.8–2.5 cm, the peduncle 1–3 cm long, 1 mm diam., the axes densely strigillose, the primary branches 10–15 per side, each 4–10-flowered, subtended by linear-subulate bracts 2–3 mm long, branching again 1–2 times; flowers 4-merous, distylous, on densely strigillose pedicels 0.3–1 mm long, the bracts subulate, 1 mm long, the hypanthium 0.7–0.8 × 0.6–0.7 mm, compressed, strigillose, the calyx cup 0.4 mm long, the lobes subequal or unequal, 1 often larger, narrowly triangular to linear-subulate, 0.5–1.2 × 0.1–0.2 mm, the other 3 triangular to narrowly triangular, 0.2–0.8 × 0.1–0.2 mm, externally strigillose, internally glabrous, each sinus with a minute brown gland; corolla red or salmon-pink when fresh, hypocrateriform, the tube 4–5 × 0.6–1 mm medially, externally sparsely strigillose or glabrous, internally retrorse puberulent toward base with a densely hirtellous ring basally, the lobes 4, spreading 90°, suborbicular, 1–2 × 1–2 mm, externally strigillose-setose, internally glabrous, the margin crisped; long-styled flowers with stamens attached 1.5 mm below apex of tube, the anthers linear-ellipsoid, 1.2 mm long, the style 4.5–5.5 mm long, the 2 stigmas 0.3–0.4 mm long, short-styled flowers with stamens attached 1 mm below apex of tube, the anthers 1.2–1.3 mm long, the style 2.5 mm long, the 2 stigmas 0.7 mm long; disc annular, 0.3 mm diam., glabrous. Capsules 2.5–3.5 mm diam., globose, compressed, bisulcate, weakly 8-ribbed, sparsely strigillose, apically loculicidal, then splitting septicidally; seeds 0.4–0.6 mm long, rhomboidal-angulate, the testa brown, foveolate-reticulate.

Distribution. Mexico, known from the Sierra Madre Orientale in Hidalgo, Puebla, and Veracruz states.

Habitat. "Bosque caducifolio" (semideciduous mesic montane forest with *Liquidambar, Quercus, Alnus, Meliosma, Ulmus,* and *Clethra), Pinus-Quercus* forest, and riparian forest with *Platanus, Heliocarpus,* and *Ternstroemia,* at 1300–1900 m elevation. Collected in flower in January to March, and October to November; collected in fruit in April, June to August, and November.

The name *Rondeletia capitellata* Hemsley has been misapplied to most herbarium collections I have seen of *R. pringlei.* In his Rubiaceae treatment for *North American Flora,* Standley (1918) also confused *R. pringlei* with *R. capitellata* (synonym *R. liebmannii* Standley), a closely related species occurring in cloud forests at 1100–2500 m elevation in the Sierra Madre de Oaxaca. *Rondeletia capitellata* differs by its densely whitish, purplish, or brownish villous-velutinous stems, larger adaxially rugose leaves with a denser pubescence of flat, twisted hairs on the upper surface and spreading-hirtellous hairs on the lower surface veins and costa, densely tomentose-villous hypanthium and calyx lobes, longer unequal, linear-lanceolate calyx lobes 0.8–2.5 mm long, more densely strigillose-hirtellous, red (rarely yellow) corollas with hairs to 0.5 mm long and tube 9–11 mm long, and larger capsules 3–4 mm diam. *Rondeletia pringlei* is also related to *R. secundiflora* B. L. Robinson from southern Mexico and Guatemala, which differs in its spreading hirtellous or villous pubescence on the floral hypanthium and capsules and white or pale yellow corollas. This new species is named for Cyrus Guernsey Pringle (1838–1911), who made extensive botanical collections in Mexico.

Paratypes. MEXICO. **Hidalgo:** Mpio. de Tenango de Doria, camino de Tenango de Dorio a El Cirio, 6 km E de Tenango, 1750–1800 m, 9 nov. 1985, *Lorence & Hernández M. 4903* (MEXU, MO); Mpio. de Zacualtipan, Tlahuelompan, 12 km S de Zacualtipan, 1900 m, 4 mar. 1982, *Hernández M. & Tenorio L. 7091* (MEXU, MO); Río Malila, 7 km al S de Molango, 1490 m, *Ramírez & Riba 648* (PTBG, XAL). **Veracruz:** Mpio. de Acajete, barranca Plan de Cedeño, 1500 m, 30 ene. 1976, *Ventura F. 12369* (ENCB, MO); Mpio. de Banderilla, 3 km al W de Banderilla, 1600 m, 16 Feb. 1982, *Dorantes 502* (MO); Piletas, cerca de Banderilla, 1600 m, 11 ene. 1973, *Hernández M. & Dorantes L. 1766* (MEXU, MO); Mpio. de Catemaco, Loma Larga, N de la laguna de Catemaco, 17 sep. 1966, *Sousa S. 2808* (MEXU, MO); Mpio. de Chiconquiaco, camino de Cuesta de Gutierrez Zamora a Barranca del Maiz, 1600 m, 19°47′N, 96°47′W, *Gutierrez B. 2872* (PTBG, XAL), 1300 m, 19°46′N, 96°49′W, 1300 m, *Gutierrez B. 2640* (PTBG, XAL); Mpio. de Huatusco, 1 km NW of Elotepec, along road to Chichiquila, 1700 m, 17 jan. 1984, *Nee & Taylor 28872* (F, MO); Mpio. de Jilotepec, El Esquilon, 1370 m, 7 ene. 1976, *Ortega O. et al. 90* (MO); Mpio. de Orizaba, Cerro San Cristobal al SE de Orizaba (al SE de la autopista), 1600 m, 29 ago. 1985, *Lorence 4845* (MEXU); Paredes al N de Jalapa, carretera a Mizantla, 1740 m, 21 abr. 1983, *Tenorio et al. 3657* (MEXU, MO); Orizaba, *Botteri s.n.* (P), *Botteri 1015* (P), *Muller 638* (P); Mpio. de Tequila, carretera Orizaba a Tequila, a 5 km S de San Andrés

Figure 6. *Crusea andersoniorum* Lorence. —a. Habit. —b. Detail of node with stipule. —c. Flower with calyx. —d. Corolla, opened. —e. Style. —f. Fruit. —g. Fruit, showing cocci, bifid carpophore, and deciduous calyx. All from *Breedlove 62063*. Bars = 1 cm in a, 5 mm in b, 12 mm in c, d, 15 mm in e, 9 mm in f, g.

Tejapan, 1500 m, 31 jul. 1983, *Lorence & Ramamoorthy 4296* (MEXU, MO, PTBG); Mpio. de Tlacolulan, Cuesta del Pericon o Cerro de La Cruz, 1700 m, 19°40′N, 96°59′W, 27 oct. 1984, *García-Orta 117* (PTBG, XAL); Mpio. de Xico, Rancheria de Coatitlan, 19°29′N, 97°04′W, 1820 m, 11 ene. 1980, *Calzada 5747* (F, MO); Mpio. de Yecuatla, Gutierrez Zamora, 19°46′N, 96°49′W, 1500 m, 22 mar. 1978, *Smith & Smith 6015* (F, MO); without precise locality, Vera Cruz to Orizaba, 1857, *Muller 638* (K).

SPERMACOCEAE

Crusea andersoniorum Lorence, sp. nov. TYPE: Mexico. Oaxaca: [Distrito of Miahuatlán], crest of ridge and steep SW facing slope 90–100 km SE of Sola de Vega along road to Puerto Escondido, elevation 1830 m, 25 Oct. 1984, *D. E. Breedlove 62063* (holotype, CAS 727669 (photo PTBG)). Figure 6.

Species habitu suffruticoso 2 m alto, ramunculis bisulcatis, sulcis albopuberulis, stipulis uniaristatis, floris fructibusque maioris a congeneribus bene distincta.

Shrub 2 m tall, young stems 1 mm diam., terete, bisulcate with hirtellous white pubescence in the grooves, older stems 2–3 mm diam., woody, the internodes 0.5–2.5 cm long, the bark reddish brown, peeling. Leaves opposite, those of a pair equal, shortly petiolate; petioles 1–1.5 mm long, narrowly winged, adaxially hirtellous and flattened; lamina lanceolate or narrowly oblong, 15–35 × 4–10 mm, the apex acute or slightly acuminate, the base narrowly cuneate to attenuate, stiffly chartaceous, discolorous, adaxially dull green, glabrous except hirtellous along sunken costa, abaxially pale green, glabrous, the costa raised, the venation obscure, the secondary veins 2 per side, the margin revolute, sparsely ciliolate toward the apex; stipules interpetiolar, the sheath 2–3 mm long, 1–2 mm wide distally, glabrous or sparsely hirtellous externally, the body triangular, 0.3–0.5 × 0.6–1.5 mm, externally sparsely hirtellous, prolonged into a glabrous, subulate awn 1.5–2 mm long. Inflorescence terminal, a bracteate capitulum, the bracts 4, subsessile, the larger pair leaf-like, the smaller pair narrowly elliptic, 10–15 × 3–4 mm, with 13–23 flowers per capitulum, nearly all the flowers opening simultaneously, mixed with stiff, white acicular trichomes; hypanthium 2–2.5 × 0.8–1 mm, villosulous with white, unicellular trichomes; calyx ca. ⅓ length of corolla, the calyx tube 0.7–0.8 mm long, sparsely villosulous externally, the calyx lobes 4, subequal, linear-subulate, 3–4 × 0.2–0.4 mm, the margins involute and sparsely ciliolate toward the base, usually bearing several setae at the apex; corolla white, hypocrateriform, the tube 12–13 × 0.5–0.7 mm medially, slightly flared distally, externally minutely papillose-puberulent, internally glabrous, the lobes ovate, 3–4 × 1.5–1.8 mm, usually recurved, both surfaces minutely papillose-puberulent; stamens exserted, the filaments attached at apex of tube, 3 mm long, glabrous, the anthers ellipsoid, 1.2–1.4 mm long; style 15 mm long, glabrous, the 2 stigmatic lobes 0.5 mm long. Fruit with a bifid carpophore, the base 2.5–3 mm long, the lobes 0.9–1 mm long, the calyx apparently deciduous at maturity of cocci, the calyx lobes spreading; cocci (immature) reddish brown, 3–5 × 1.2–1.5 mm, broadest toward the apex, externally villosulous with flat or twisted, spreading white hairs, denser toward the apex; immature seed free from the thick coccus wall, ca. 2.5 mm long, black.

Distribution. Known only from the type, collected in the Miahuatlán District in southern Oaxaca, Mexico (label lacks habitat notes).

Crusea Schlechtendal & Chamisso is a genus of about 14 species of annual or perennial herbs centered in Mexico and northern Central America (Anderson, 1972). Although the shrubby habit of this new species was unexpected in this genus, its bilocular fruit, which is longitudinally dehiscent into two cocci separating from the persistent bifid carpophore, and deciduous calyx are diagnostic characters of *Crusea*. This new species differs from its congeners in its shrubby habit, bisulcate stems with white pubescence in the grooves, stipules with a single awn-like projection, large white flowers, and fruits with large cocci (mature ones were not available). This new species is named for William R. Anderson, who revised the genus *Crusea*, and his wife, Christiane Anderson, in recognition of their extensive contributions to plant systematics.

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A Synopsis of the Genus *Prestonia* (Apocynaceae) Section *Tomentosae* in Mesoamerica

J. Francisco Morales
Instituto Nacional de Biodiversidad (INBio), Apto. 22-3100, Sto. Domingo de Heredia, Costa Rica

ABSTRACT. The species of *Prestonia* (Apocynaceae) sect. *Tomentosae* in Central America are treated in a brief synopsis: new synonymies are provided and three new species, *Prestonia clandestina*, *P. hammelii*, and *P. riverae*, are described. In addition, *Prestonia seemannii* Miers is removed from synonymy of *P. ipomaefolia*.

The genus *Prestonia* R. Brown contains about 60 species, ranging from Mexico to Argentina, with the center of distribution in the tropics and adjacent areas (Woodson, 1936). The genus is defined by the presence of epistaminal appendages within the corolla tube, in conjunction with an annular callus around the mouth of the tube and calyx lobes with entire or lacerate squamellae. Though closely related to *Rhodocalyx* and *Laubertia*, *Prestonia* can be distinguished from the former by its habit (vine or liana) and the usually axillary inflorescence, and from the latter by its glandular calyx.

Section *Tomentosae* is characterized by the pubescent corolla and leaves. The pubescence of the leaves exhibits great intraspecific variation. The annular callus may be reduced, absent, or 5-lobed, and the epistaminal appendages may be absent or reduced to linear, usually inconspicuous, callus ridges. The great intraspecific variation in this group makes it one of the most taxonomically difficult sections in the genus.

Since Woodson's (1936) monograph, no other treatments of the Mesoamerican species of *Prestonia* sect. *Tomentosae* have been published, with the exception of Woodson's (1938) treatment for the North American Flora, which basically included the same species. Subsequently, more species have been described and Woodson's treatments have become obsolete.

During preparation of the treatments of Apocynaceae for the *Manual de las Plantas de Costa Rica* and *Flora Mesoamericana* all available herbarium material of *Prestonia* sect. *Tomentosae* from the Mesoamerican area was examined. This study revealed the inconsistency of such characters as the form and degree of laceration of the squamellae, which are correlated with the stage of floral development: at anthesis, the squamellae are generally entire or scarcely lacerate, but later exhibit many different kinds of laceration. Sometimes a squamella, when deeply lacerated, may be mistaken for many separate squamellae. Since many ostensibly distinct species have been based on such orthogenetic differences, it has become necessary to synonymize many names.

Furthermore, examination of type collections and representative specimens from different sites within the range of some species (i.e., *Prestonia mexicana* A. DC.) shows that variation in the length and degree of lobulation of the nectary is considerable, even in specimens from the same locality, and hence these characters cannot be used to separate species.

Examination of the type specimen and several collections of *Prestonia ipomaeifolia* A. DC. from South America has convinced me to reinstate the Panamanian *Prestonia seemannii* Miers, which had been placed in synonymy of the former by Hemsley (1881). In addition, three new species were encountered.

KEY TO THE SPECIES OF *PRESTONIA* SECT. *TOMENTOSAE* IN MESOMERICA

1a. Corolla infundibuliform.
  2a. Lower part of corolla tube less than 4 mm long, upper part 4–6 mm long, lobes 29–36 mm long; pedicels usually less 4 mm; leaves usually glabrate and shiny at maturity, subcoriaceous . . . . . *P. clandestina* J. F. Morales
  2b. Lower part of corolla tube 12–19 mm long, upper part 10–12 mm long, lobes 20–25 mm long; pedicels 9–17 mm; leaves puberulent (rarely glabrate) and opaque, membranaceous . . . . . *P. speciosa* Donnell Smith
1b. Corolla salverform.
  3a. Epistaminal appendages absent or reduced to inconspicuous callus ridges; lower part of corolla tube 18(usually 20)–36 mm long.
    4a. Leaves and inflorescence very sparsely pubescent; corolla and calyx with a few scattered hairs *P. hammelii* J. F. Morales
    4b. Leaves, inflorescence, corolla, and calyx densely pubescent.
      5a. Flowers sessile or with the pedicels

less than 3 mm; anthers 10–12 mm; fruits falcate and curved . . . . . *P. riverae* J. F. Morales

5b. Flowers with the pedicels 5–32 mm; anthers 6–7 mm; fruits napiform and straight (or nearly so) . . . . . *P. mexicana* A. DC.

3b. Epistaminal appendages present; lower part of corolla tube 5–15 mm long.

6a. Leaves, calyx, and corolla sparsely hispid to hispidulous beneath, sometimes glabrate at maturity; plants from the Darién and northern South America . . . . . *P. ipomaeifolia* A. DC.

6b. Leaves, calyx, and corolla pubescent, tomentose to velutinous beneath, never glabrate at maturity; plants from central Panama.

7a. Lower part of corolla tube 5–6 mm long, the lobes 4–5 mm; sepals less 6 mm long; leaves coriaceous . . . . . *P. tysonii* A. H. Gentry

7b. Lower part of corolla tube 10–13 mm long, the lobes 9–15 mm; sepals 9–11 mm long; leaves membranaceous . . . . . *P. seemannii* Miers

Prestonia clandestina J. F. Morales, sp. nov. TYPE: Mexico. Veracruz: Mpio. San Andres Tuxtla, Estación de Biología Tropical Las Tuxtlas, 200 m, 13 July 1984 (fl, fr), *Ibarra & Sinaca 1893* (holotype, INB; isotypes, MO, NY).

Foliorum lamina subcoriacea. Pars basalis tubi corollae multo brevior et lobi longiores quam partes comparabiles *Prestoniae speciosae.*

Liana, branchlets velutinous-pilose to glabrate. Leaf blades 12–24 × 5.5–14 cm, subcoriaceous, obovate to elliptic, obtuse, acute to long-acuminate at the apex, cuneate at the base, shiny and sparsely puberulent to glabrate above, densely tomentose to velutinous-tomentose beneath, indument yellow-brownish, eglandular, petiole 0.5–1.5 cm, glandular in the axils, stipules almost linear, 6–9 mm. Inflorescence subumbelliform, rather densely agglomerate, peduncle 1.4–2.6 cm thick, pedicels 1–4 mm, both hirsute-velutinous, bracts 4–14 × 1–2.5 mm wide basally, ovate to very narrowly elliptic; sepals 1.6–2.3 cm × 3–7 mm, narrowly ovate, acute to acuminate, velutinous-adpressed, squamellae ca. 3 mm long, pubescent, apex scarcely fimbriate; corolla infundibuliform, yellow to cream, densely puberulent, lower part 3–4 × 5 mm, upper part 4–6 × 6–10 mm diam. at the orifice, infundibuliform, epistaminal appendages absent, callus scarcely visible, lobes 2.9–3.6 × 1.4–1.7 cm obovate to narrowly obovate; stamens included sometimes somewhat exserted, filaments ca. 2.5 mm, glabrous, anthers 7–8 mm, glabrous, ovary ca. 1 mm, glabrous, style 5–6 mm; disk ca. 1.5 mm long, annular, scarcely lobed. Follicles 9.5–12 × 1.8–2.2 cm, divaricate to somewhat falciform, velutinous-tomentose; seeds 1.1–1.6 cm × 3–4 mm, rugose, coma 3.5–3.8 cm, cream.

Distribution and habitat. *Prestonia clandestina* is known only from a few collections from Mexico, where it occurs in secondary and disturbed forest and open areas, from 20 to 900 m.

Phenology. Flowers May to July; fruits in February.

All the collections examined were previously identified as *Prestonia mexicana,* but the new species is more similar to *P. speciosa* Donnell Smith in its infundibuliform corolla. It differs most strikingly from the latter species in its short corolla tube and larger corolla lobes. Also, the leaves are generally somewhat shiny, glabrate, and subcoriaceous at maturity in *P. clandestina,* versus membranaceous, puberulent, and opaque in *P. speciosa.* These are the only two species in the genus with an infundibuliform corolla.

Paratypes. MEXICO. **Chiapas:** Chitallin, Mpcio. Yajalon, 10 Feb. 1984, *Mendez 7230* (MEXU, NY). **Oaxaca:** Tuxtepec, Chiltepec and vicinity, 20 m, July 1940, *Martinez 57* (AA, US). **Veracruz:** Cerro Cintepec, Este de Zapoapan, Catemaco, 800 m, 8 Feb. 1972, *Beaman 5614* (F, US); Estación de Biología Tropical Las Tuxtlas, San Andres de Tuxtla, 150 m, 7 May 1972, *Calzada 834* (F, MEXU, MO).

Prestonia hammelii J. F. Morales, sp. nov. TYPE: Costa Rica. Puntarenas: Reserva Forestal Golfo Dulce, Osa Peninsula, Rancho Quemado, ca. 15 km W of Rincón, in bottom of valley along Río Riyito near bridge and in forest along road on ridge above valley, 250–350 m, 31 May 1988 (fl), *Hammel et al. 16918* (holotype, INB; isotype, MO).

Prestoniae ipomaeifoliae affinis, a qua imprimis differt inflorescentia laxa, magnitude floris, tubi corollae appendicibus stamineis nullis.

Liana, branchlets sparsely puberulent to glabrate. Leaf blades 11–24 × 4.8–13.5 cm, membranaceous to subcoriaceous, elliptic to narrowly elliptic, long acuminate in the apex, obtuse basally, sparsely hirsutulous on both surfaces, indument brown, eglandular, petioles 0.7–2 cm, glandular in the axils, stipules absent. Inflorescence racemose to subumbelliform, lax, peduncle 3.5–4 cm, thin and woody, pedicels 6–11 mm, both hirsutulous, bracts 2–6 mm × 1–1.5 mm, linear or nearly so; sepals 1–1.5 cm × 3 mm, very narrowly ovate, acuminate, sparsely hirsutulous, squamellae ca. 2 mm,

fimbriate; corolla salverform, yellow, sparsely hirsute, tube 2.1–2.3 cm × 3 mm, epistaminal appendages absent or reduced to callus ridges near the base of the stamens, callus short and reduced, inconspicuous, lobes 1.4–1.6 × 0.8–0.9 cm, obovate; stamens included, filaments 3.5–4 mm, anthers 9–10 mm, glabrous, ovary less than 0.8 mm long, glabrous, style 11–14 mm; disk ca. 1 mm long, annular, scarcely 5-lobed. Follicles unknown.

Distribution. Tropical wet forest in southwestern Costa Rica, at elevations of 200–600 m.

Phenology. Flowers March to May.

The pubescence of the leaves and the inflorescence (corolla, calyx, bracts) is highly variable within most of the species of section *Tomentosae* (including those known from the South American continent). Sometimes the leaves may be glabrate at maturity, but those of the younger stems are always pubescent. *Prestonia hammelii* is one of the few species with leaves almost glabrate at all stages; the only other one occurring in Mesoamerica is *P. ipomaeifolia,* but *P. hammelii* differs clearly from this species in its larger flowers, lax inflorescences, and in the absence of epistaminal appendages.

Prestonia hammelii is named after Barry Hammel of the Missouri Botanical Garden in recognition of his extensive work in Costa Rica and especially for his friendship and personal support of my studies on Apocynaceae.

Paratypes. COSTA RICA. **Puntarenas:** Fila Costeña, S of San Isidro del General, in the Cabeza de Mono, 12 km S of Tumbas, 400–600 m, 6 Mar. 1985, *Taylor et al. 4871* (DUKE).

Prestonia ipomaeifolia A. DC., Prodr. 8: 429. 1844. TYPE: French Guiana: Cayenne, date lacking, *le Blond s.n.* (holotype, G-DC not seen; photo, INB ex G).

Liana, branchlets sparsely hirsute to hirsutulous, rugose. Leaf blades 14–30 × 8.5–18 cm, coriaceous to subcoriaceous, elliptic to narrowly elliptic, long acuminate in the apex, obtuse, rounded to scarcely cordate basally, sparsely hirsutulous to hirsute on both surfaces, sometimes glabrate above, indument yellow, eglandular, veinlets conspicuously reticulated, petiole 1–2.5 cm, glandular in the axils, stipules absent. Inflorescence subumbelliform to somewhat racemose, agglomerate, peduncle 1.5–3(–4.5) cm, thick and somewhat woody, pedicels 3–8(–14) mm, both sparsely hirsute, indument yellow, bracts 6–17 × 1–2.5 mm, very narrowly elliptic to ovate; sepals 0.7–1.1 cm × 2.5–6 mm, ovate to narrowly elliptic, acute to short-acuminate, sparsely hirsutulous, squamellae ca. 3 mm long, apex somewhat fimbriate; corolla salverform, yellow to cream, hirsutulous, tube 1.2–1.5 cm × 3 mm, epistaminal appendages ca. 2 mm, apex exserted, callus scarcely visible, lobes 0.8–1.2 × 0.6–0.7 cm, obovate; stamens included, filaments 1.5–2 mm, glabrous, anthers ca. 6 mm, glabrous, ovary ca. 1 mm long, glabrous, style 8–10 mm; disk 2–3 mm, annular, entire to scarcely 5-lobed. Follicles unknown.

Distribution. Tropical wet forest from the Darién Province, Panama, to Colombia, Ecuador, Peru, and the Guianas, at elevations below 500 m.

Phenology. Flowers May to July; fruits mainly in July.

This species is known from only a few collections. Material from central Panama with pubescent leaves and epistaminal appendages has been erroneously included under this name, due to the fact that Hemsley (1881) relegated *P. seemanii* (to which most of the Panamanian material belongs), to synonymy under *P. ipomaeifolia.* However, *P. ipomaeifolia* differs from *P. seemannii* in its larger and coriaceous leaves, with smaller flowers.

Specimens examined. PANAMA. **Darién:** near the mouth of Río Yape, 12 July 1937, *Allen 366* (MO); vicinity of El Real, Río Tuira, 1 July 1959, *Stern et al. 778* (MO, US).

Prestonia mexicana A. DC., Prodr. 8: 429. 1844. TYPE: Mexico. San Bartolo, in ditione de Oaxaca, Aug. 1834, *Andrieux 251* (holotype, G not seen; photo, F, INB, MO, NY, US ex G).

Echites conglobata Sessé & Moçiño, Fl. Mexic. 45. 1893. Syn. nov. TYPE: Mexico, *Sessé et al. 5082* (holotype, MA not seen; fragment, F).

Prestonia isthmica Woodson, Ann. Missouri Bot. Gard. 18: 555. 1931. Syn. nov. TYPE: Costa Rica. Between Aserri and Tarbaca, 6 Dec. 1925, *Standley 41332* (holotype, US).

Prestonia amanuensis Woodson, Ann. Missouri Bot. Gard. 23: 359. 1936. Syn. nov. TYPE: British Honduras. 6 mi. S. Railway, Aug. 1929, *Schipp S-7* (holotype, B destroyed; lectotype, designated here, NY; isolectotypes, F, GH).

Prestonia remediorum Woodson, Ann. Missouri Bot. Gard. 26: 299. 1939. Syn. nov. TYPE: Panama. Chiriquí: Rio Chiriquí to Remedios, 11 July 1938, *Woodson et al. 1180* (holotype, MO).

Prestonia allenii Woodson, Ann. Missouri Bot. Gard. 27: 332. 1940. Syn. nov. TYPE: Panama. Coclé: N rim of El Valle, 4 June 1939, *Allen 1855* (holotype, MO; isotypes, F, NY, US).

Prestonia wedelii Woodson, Ann. Missouri Bot. Gard. 29: 365. 1942. Syn. nov. TYPE: Panama. Bocas del Toro: Water Valley, 26 Oct. 1940, *von Wedel 1353* (holotype, MO; isotype, US).

Liana, branchlets variously pubescent, turning glabrate at maturity. Leaf blades 8–27 × 5–16 cm,

membranaceous to subcoriaceous, orbicular, elliptic to narrowly elliptic, acute, long acuminate to obtuse in the apex, cuneate to obtuse basally, puberulent above, variously tomentose beneath, indument yellow-brownish to somewhat ferrugineous, petiole 0.5–2.2 cm, glandular in the axils, stipules absent. Inflorescence umbelliform or subumbelliform to racemose, rather densely agglomerate, peduncle 0.9–4.4 cm, thick and woody, pedicels 5–32 mm, both pilose to pubescent, bracts 0.3–1.2 cm × 1–2.5 mm, very narrowly ovate, pubescent, foliaceous to somewhat scarious; sepals 1.4–3 cm × 4–12 mm, ovate to very narrowly so, acute to long acuminate, pubescent to tomentose, squamellae 1–3 mm long, entire to variously fimbriate; corolla salverform, cream to green-yellow, puberulent to sparsely pubescent, tube 2.4–3.6 cm × 4–5 mm, straight, sometimes gradually expanded to the orifice, epistaminal appendages absent or reduced to callus ridges, callus entire to deeply 5-lobed, lobes 1.2–1.6 × 0.9–1.1 cm, obovate; stamens included or with the apex exserted, filaments ca. 2 mm, glabrous, anthers 6–7 mm, glabrous, ovary 1–1.5 mm, glabrate to pubescent, style 20–30 mm; disk 1–2 mm, annular, entire or 5-lobed to variously lacerate. Follicles 5.5–11 × 1–2 cm, divaricate, napiform and straight (or nearly so), densely pilose, calyx sometimes persistent; seeds 1.1–1.5 cm × 2–3 mm, rugose, coma 3.5–4 cm, cream.

Distribution. Mexico to Panama, in primary and secondary forest and disturbed areas, where sometimes common, at 0–1800 m.

Phenology. Flowers January to October; fruits all year.

Prestonia mexicana is among the most variable and widespread species in the genus.

The characters used to separate *P. allenii*, *P. wedelii*, and *P. remediorum*, such as the form and degree of laceration of the squamellae and the lobulation of the annulus, do not appear to vary in a manner consistent with the specific entities envisioned by Woodson. More recent collections show many intermediate states of variation in these characters.

Prestonia isthmica, from the Central Valley of Costa Rica around San José, is characterized by a long (3–4 mm) nectary, longer than the ovary, but all the other characters of the plant correspond to *P. mexicana* and there seems no valid reason to maintain *P. isthmica* as a different species or even variety.

Prestonia amanuensis, described from British Honduras (now Belize), differs in its short corolla, but corolla length is a highly variable character in *Prestonia* and some other genera of Apocynaceae (Morales, 1995). Also, the length of the calyx lobes is very variable in *Prestonia mexicana*, even among specimens from the same locality.

Fruiting collections of *P. mexicana* are difficult to separate from those of *P. speciosa*, which has similar leaves. However, the sepals of *P. mexicana* are larger and mostly persistent. Only a selection of specimens examined are cited for each country, but a list of all the specimens examined is available on request.

Specimens examined. MEXICO. **Campeche:** 5 km E of Santa Maria, Xcabacab, 7 Mar. 1982, *Cabrera et al. 2075* (MEXU, MO). **Chiapas:** 32 km NW of Ocozonoautla, 27 Aug. 1972, *Breedlove 27485* (MO); W of Las Cruces, along road to La Mina microwave station, 19 Sep. 1981, *Breedlove 52929* (NY). **Guerrero:** Cañon de la Mano Negra, 4–8 km N of Iguala, 15 Feb. 1970, *Anderson et al. 5779* (DUKE); Vallecitos, Montes de Oca, 9 June 1937, *Hinton 11365* (F, MO, NY, US). **Jalisco:** Estación Biológica Chamela, 24 Sep. 1981, *Lott 567* (MEXU, MO); La Huerta, Norte de La Chamela, 25 Sep. 1981, *Lott 585* (MEXU, NY). **Michoacán:** Cruz de Campos, 2 Sep. 1980, *Soto et al. 2614* (MEXU, MO). **Morelos:** Barranca near Cuernavaca, June 1896, *Pringle 6341* (F, MO, NY, US). **Oaxaca:** Río El Aguacate, 25 July 1982, *Cadillo et al. 1685* (MO). **Quintana Roo:** NW of Puerto Felipe, Carrillo, 4 Aug. 1972, *Webster et al. 17666* (MO). **Tabasco:** Tenosique, 11 Mar. 1976, *Calzada et al. 2224* (MEXU, MO). **Veracruz:** 3 km NW of Cuitlahuac, 3 July 1980, *Hansen et al. 7571* (F, USF); Laguna Tamiahua, 3 May 1939, *LeSuer 355* (F, TEX); San Antonio Paso del Toro, Naolinco, 14 Jan. 1984, *Nee et al. 28771* (NY, XAL). **Yucatán:** Chichen Itza, July 1938, *Lundell et al. 7460* (MO). GUATEMALA. **Alta Verapaz:** Cubilquitz, Aug. 1903, *Tuerckheim 8539* (US). **Baja Verapaz:** San Jeronimo, 24 July 1988, *Tenorio et al. 14791* (MO). **Jutiapa:** vicinity of Jutiapa, 24 Oct. 1940, *Standley 75305* (MO). **Petén:** Tikal National Park, bajo Santa Fe, 16 Feb. 1959, *Lundell 15573* (MO, NY, TEX). **Santa Rosa:** Sta. Rosa, May 1892, *Heyde & Lux 3161* (US). BELIZE. **Cayo:** N of Blancameaux Lodge, Mount Pine ridge, 12 July 1973, *Dwyer 11632* (F, NY); S of El Millionario, 29 May 1973, *Gentry 7660* (F, MO); Cohune Ridge, Aug. 1936, *Lundell 6462* (MICH, MO, NY, US). **Toledo:** Acahual, near Orange Point, 29 Sep. 1951, *Gentle 7452* (NY). HONDURAS. **Cortés:** Potrerillos, Aldea El Olivo, 13 Apr. 1975, *Erazo 65* (MO). **Francisco Morazán:** Quebrada Suyapa, NE of Tegucigalpa, 10 Aug. 1949, *Molina 2569* (EAP, US). **Yoro:** Cordillera Nombre de Dios, hills S of San José de Texiguat, 17 May 1991, *Davidse et al. 34506* (INB, MO). EL SALVADOR. **Ahuachapán:** Parque Nacional El Imposible, *Sermeño 30* (LAGU, MO); vicinity of Ahuachapán, 9 Jan. 1922, *Standley 19913* (NY). NICARAGUA. **Boaco:** Piedra Sembrada al N de Camoapa, 29 Aug 1991, *Moreno 10596* (MO). **Chinandega:** Volcán San Cristobal, 3 Aug. 1984, *Hernandez et al. 584* (MO). **Estelí:** near of Entrance of Estelí, 30 Dec. 1977, *Stevens 5780* (MO). **Granada:** Volcán Mombacho, 300 m, 19 Sep. 1976, *Neill 776* (MO). **Matagalpa:** El Barro, 18 Nov. 1984, *Moreno 25056* (MO). **Nueva Segovia:** Quebrada El Nancital, 7 Aug. 1977, *Stevens 3007* (MO). **Zelaya:** near Zelaya, 6 Jan. 1982, *Ortiz 553* (MO). COSTA RICA. **Alajuela:** Los Angeles de San Ramon, 21 Dec. 1936, *Solis 478* (MO). **Cartago:** Forest of Tuis, Nov. 1897, *Tonduz 11553* (US). **Guanacaste:** Parque Nacional Santa Rosa, 17 June 1979, *Janzen 11694* (MO); collines de Nicoya, May 1900, *Ton-*

duz 13945 (US). **Heredia:** Santo Domingo, 31 Oct. 1993, *Hammel et al. 19106* (CR, INB, MO). **Limón:** Talamanca, Rio Barbilla y Quebrada Cañabral, 20 Oct. 1988, *Herrera et al. 2224* (F, INB, MO). **Puntarenas:** Reserva Forestal Golfo Dulce, Rancho Quemado, 17 Aug. 1992, *Aguilar et al. 1249* (INB); Rio Ceibo, pres Buenos Aires, Feb. 1892, *Tonduz 6692* (US). **San José:** Cerros de Escazu, Rio Saurez, *Morales et al. 2278* (CR, INB, F, MO); vicinity of San José, Feb. 1924, *Standley 34797* (US). PANAMA. **Bocas del Toro:** Water Valley, 31 Oct. 1940, *von Wedel 1452* (MO). **Chiriquí:** vicinity of Chiriquí Lagoon, 13 Nov. 1941, *von Wedel 1611* (US). **Coclé:** El Valle de Anton, July 1935, *Siebert 493* (MO). **Colón:** Santa Rita ridge, Jan. 1968, *Dwyer et al. 9025* (MO). **Panamá:** El Llano–Carti road, 28 Mar. 1974, *Nee et al. 10963* (MO).

Prestonia riverae J. F. Morales, sp. nov. TYPE: Costa Rica. Guanacaste: Parque Nacional Rincón de la Vieja, Sector El Canal, 900 m, 2 Apr. 1991 (fl, fr), *Rivera 1211* (holotype, INB; isotypes, CR, MO). Figure 1.

Prestoniae mexicanae affinis, a qua imprimis differt foliis infra dense tomentosis, floribus quasi sessilibus, antheris longissimis.

Liana, young branchlets hirsute-velutinous, ferrugineous, becoming sparsely puberulent at maturity. Leaf blades 9–23 × 5.5–13 cm, membranaceous to subcoriaceous, narrowly elliptic to orbicular, acute to short acuminate in the apex, obtuse to rounded basally, sparsely puberulent above, velutinous-tomentose beneath, indument ferrugineous, eglandular, petiole 0.6–1.8 cm, glandular in the axils, stipules absent. Inflorescence umbelliform, agglomerate, peduncle 0.8–2.3 cm, pedicels less 3 mm, usually absent, both velutinous-tomentose, bracts 6–8 × 2 mm, narrowly elliptic; sepals 1.5–2.4 cm × 4–6.5 mm, narrowly ovate to narrowly elliptic, acute to acuminate, pubescent, squamellae ca. 3 mm, usually entire to somewhat fimbriate, pubescent; corolla salverform, yellow, strigose-tomentose, tube (1.8–)2–2.3 cm × 3 mm, epistaminal appendages absent, callus short and inconspicuous, lobes 0.9–1.2 cm × 8–9 mm, obovate; stamens inserted, filaments ca. 2 mm, glabrous, anthers 10–12 mm, glabrous, ovary ca. 1 mm, glabrous, style 10–11 mm long; disk ca. 1 mm, annular, scarcely lobed. Follicles 15–20 × 1.2–2 cm, falcate, long acuminate, usually curved, ferrugineous-hirsute; seeds 1–1.2 cm, rugose, coma 4.5–5 cm, tan.

Distribution. Restricted to Costa Rica, where it occurs on the slopes of the Cordillera de Guanacaste and in the Sarapiquí region, in forest and disturbed areas, at 100–900 m.

Phenology. Flowers April to August; fruits August to October.

This species is unusual in having the largest anthers of the genus. It is related to *P. mexicana*, which is widespread in Central America, but differs by the larger anthers, obsolete or very reduced (less than 3 mm long) pedicels, and long falcate fruits.

Prestonia riverae is named after Gerardo "El Indio" Rivera, who collected this and many other interesting plants in Rincón de la Vieja National Park, Costa Rica.

Paratypes. COSTA RICA. **Alajuela:** Buena Vista de San Carlos, 2 May 1964, *Jimenez 1952* (CR, MO, NY). **Guanacaste:** Parque Nacional Rincón de la Vieja, Hacienda Santa Maria, 17 Aug. 1987, *Herrera 736* (CR, F, MO); Rincón de la Vieja, Finca Los Mora, 12 Oct. 1990, *Rivera 728* (INB, MO). **Heredia:** Finca La Selva, Puerto Viejo de Sarapiquí, 24 July 1979, *Grayum 2027* (DUKE); Sarapiquí, 4 June 1980, *Hammel 8921* (DUKE, INB); Finca La Selva, Sarapiquí, 26 July 1984, *Jacobs 2977* (DUKE, INB), 28 May 1985, *Jacobs 3190* (DUKE, INB), 28 Sep. 1981, *Smith 304* (DUKE, INB).

Prestonia seemannii Miers, Apocyn. S. Amer. 146. 1878. TYPE: Panama: near the town of Panamá, *Seemann 159* (holotype, BM; photo, INB ex BM).

Liana or vine, branchlets sparsely hispid to glabrate. Leaf blades 6–21(–26) × 3–12 cm, membranaceous, narrowly elliptic to obovate, acute to long acuminate in the apex, obtuse to rounded basally, hispid-velutinous above, velutinous to velutinous-tomentose beneath, indument yellow-tannish, eglandular, petiole 0.2–1 cm, glandular in the axils, stipules absent. Inflorescence subumbelliform, densely agglomerate, peduncle 1–2.6 cm, thick, pedicels 3–10 mm, both densely to sparsely ferrugineous-hispid, bracts 5–9 × 1–2 mm, narrowly elliptic; sepals 0.9–1.1 cm × 3–4 mm, ovate to narrowly elliptic, acute to short-acuminate, hispid-velutinous, squamellae 2–3 mm long, apex scarcely fimbriate; corolla salverform, yellow to cream, hispid, tube 1–1.3 cm × 3–4 mm, epistaminal appendages 1–1.5 mm, the apex exserted, callus ca. 1 mm long, conspicuous, lobes 0.9–1.5 × 0.4–0.6 cm, obovate; stamens exserted, filaments ca. 1 mm long, glabrous, anthers 5–6 mm, glabrous, ovary ca. 1 mm long, puberulent to glabrate, style 6–10 mm; disk 1.5–1.8 mm long, annular to variously 3-lobed. Follicles 10–13 × 1–1.4 cm, divaricate to somewhat divergent, hispid; seeds 1.1–1.4 cm × 2 mm, rugose, coma 2.7–3.2 cm, cream.

Distribution. Restricted to Panama, in open areas and disturbed forest, mainly in the central part of the country (Province of Panamá).

Phenology. Flowers May to November; fruits October to February.

Prestonia seemannii was regarded as a synonym of *P. ipomaeifolia* by Hemsley (1881), but is here reinstated as a valid species. The characters that

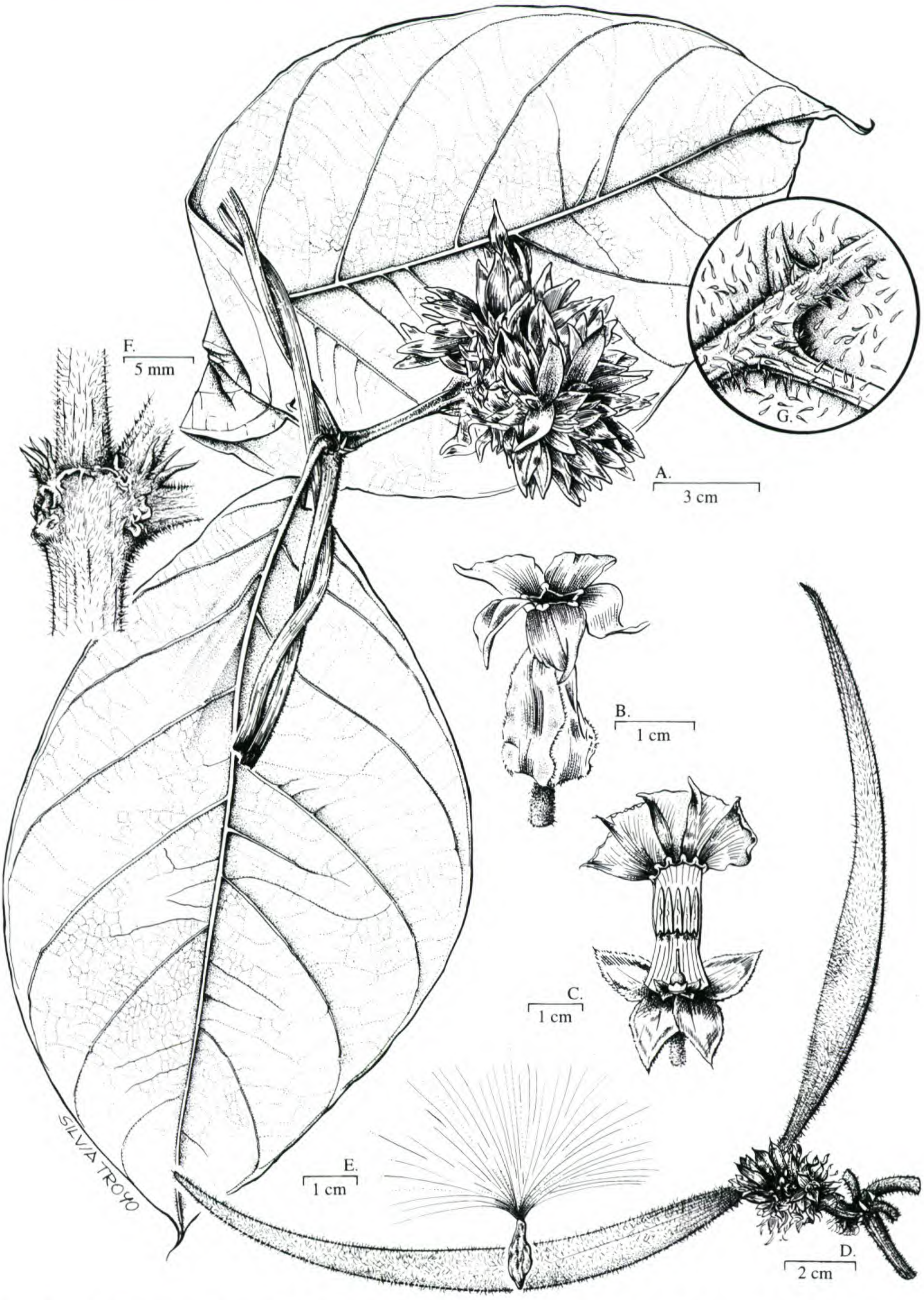

Figure 1. A–G. *Prestonia riverae* J. F. Morales (*Rivera 1211*). —A. Habit. —B. Calyx and Corolla. —C. Corolla expanded, annular callus, stamens, ovary, disk, and squamellae. —D. Fruit. —E. Seed. —F. Internodal appendages. —G. Pubescence of the leaves (beneath).

distinguish the former are its smaller and more membranaceous leaves, with yellow pubescence.

Specimens examined. PANAMA. **Coclé:** near Rio Grande, 24 May 1970, *Rosario 43* (MO). **Darién:** Pigonana from El Real, 15 July 1971, *Croat et al. 15555* (MO); vicinity of La Palma, southern Darién, Jan. 1912, *Pittier 5494* (US). **Los Santos:** Managre Beach, 29 July 1963, *Dwyer 4171* (MO). **Panamá:** vicinity of Bejuco, 18 Oct. 1938, *Allen 980* (MO); Perlas Islands, 5 July 1941, *Allen 2590* (MO); Cerro Jefe, 6 Jan. 1971, *Croat 13060* (MO); Cerro San Francisco, 16 Apr. 1986, *Correa et al. 4683* (MO); Canal Zone, Madden Dam Bridge, 12 Oct. 1967, *Correa 359* (F, MO); Canal Zone, Ancon Hill, 10 Oct. 1961, *Duke 4583* (MO); Paraiso, 29 Nov. 1966, *Dwyer 7144* (MO); Taboga Island, 15 Aug. 1972, *Gentry 5727* (MO); Tocumen, 22 Sep. 1975, *Gonzalez 30* (MO); Bellavista, 25 Feb. 1923, *Macbride s.n.* (F, US); near Tapia River, 1 June 1923, *Maxon et al. 6735* (US); La Chorrera, 27 Nov. 1975, *Medina 32* (MO, PMA); Punta Paitilla, 22 Feb. 1923, *Piper 5428* (US); near Chepo, Oct. 1911, *Pittier 4700* (US); Tumba Muerto road, 6 Jan. 1924, *Standley 29757* (US); E of Canita, 30 May 1966, *Tyson et al. 4161* (DUKE, MO); thickets near Capira, 12 July 1938, *Woodson et al. 1230* (MO).

Prestonia speciosa Donnell Smith, Bot. Gaz. (Crawfordsville) 27: 435. 1899. TYPE: Guatemala. Santa Rosa: Buena Vista, Apr. 1893, *Heyde & Lux 4497* (holotype, US; isotypes, US 3 sheets).

Prestonia grandiflora L. O. Williams, Fieldiana, Bot. 31: 402. 1968. Syn. nov. TYPE: Mexico. Chiapas: La Grandeza, 19 May 1945, *Matuda 15570* (holotype, F; isotypes, F, MO 2 sheets, TEX not seen).

Liana, branchlets pubescent to glabrate. Leaf blades 8–26 × 6–13.5 cm, membranaceous, obovate to orbicular, acuminate to caudate-acuminate in the apex, cuneate, obtuse to rounded basally, sparsely puberulent to glabrate above, tomentose beneath, eglandular, petiole 0.4–1.1 cm, glandular in the axils, stipules absent. Inflorescence corymbose to subcorymbose, peduncle 0.4–2.2 cm, pedicels 9–17 mm, both pubescent, bracts 3–8 × 1 mm, very narrowly ovate, sepals 0.9–1.7 cm × 4–6 mm, ovate to narrowly elliptic, acute to acuminate, squamellae ca. 1 mm long, apex scarcely fimbriate; corolla infundibuliform, yellow, sparsely pubescent, lower part of tube 1.2–1.9 cm × 3–4 mm, upper part 1–1.2 × 1–1.2 cm diam. at the orifice, conic-campanulate, epistaminal appendages absent, rarely reduced to inconspicuous callus ridges, callus entire to scarcely lobed, lobes 2–2.5 cm × 1.1–1.4 cm, obovate; stamens included, filaments ca. 1.5 mm long, glabrate, anthers 8–9 mm, glabrous, ovary ca. 1 mm, glabrous, style 17–18 mm long; disk 3 mm long, annular, deeply lacerate. Follicles 7–9 × 1.8–2.7 cm, divaricate, densely sericeous; seeds unknown.

Distribution. Mexico to Nicaragua, where it occurs mostly in secondary forest and in open areas, at elevations of 500–1500 m.

Phenology. Flowers March to June.

Prestonia grandiflora was separated from *P. speciosa* based solely on its longer corolla (Williams, 1968). However, the types of the two species are similar, except that the type of *Prestonia speciosa* has the corolla lobes reflexed due to the capriciousness of the drying process, while the former species has the lobes spreading.

Prestonia speciosa is characterized by its clearly infundibuliform corolla, the largest in the genus. Fruiting specimens are difficult to separate from *P. mexicana.* Only one collection (*Standley 20091,* US) with old fruits is known.

Specimens examined. MEXICO. **Chiapas:** Siltepec, 23 June 1941, *Matuda 4681* (F, MEXU, MICH, MO, NY); along the river E of Bochil, 27 June 1967, *Shilom 2597* (NY). GUATEMALA. **Quezaltenango:** Montaña Chicharro, S of Sta. Maria de Jesus, *Steyermark 34139* (F). **Zacatepequez:** Alotenango, *Donnell Smith 1448* (US). EL SALVADOR. **Ahuachapán:** El Imposible, San Benito, 16 Mar. 1992, *Sandoval et al. 311* (LAGU, MO); Sierra de Apaneca, Finca Colima, 17 Jan. 1922, *Standley 20091* (US). **La Libertad:** Puerta de La Laguna, 27 Apr. 1922, *Standley 23673* (US). **Sonsonate:** Laguna de Las Ninfas, 1829 m, 4 Mar. 1991, *Villacorta et al. 742* (LAGU, MO). HONDURAS. **Copán:** 10 mi. W of Copán, 1 Aug. 1977, *Croat 45520* (MO). NICARAGUA. **Granada:** Volcán Mombacho, 19 Apr. 1982, *Moreno 16125* (MO). **Jinotega:** Sta. Lastenia, 5 June 1982, *Stevens 21536* (MO).

Prestonia tysonii A. H. Gentry, Ann. Missouri Bot. Gard. 61: 895. 1974. TYPE: Panama. Panamá: Cerro Jefe, in Clusia forest, 27 Jan. 1966, *Tyson et al. 3214* (holotype, MO).

Liana, branchlets densely tomentose, turning puberulent at maturity. Leaf blades 8–13.5 × 4–10 cm, coriaceous to subcoriaceous, broadly to narrowly ovate, acute to acuminate in the apex, obtuse to rounded basally, glabrate above, densely velutinous-tomentose beneath, indument ferrugineous, eglandular, petiole 4–11 mm, glandular in the axils, stipules absent. Inflorescence umbelliform to subumbelliform, dense, peduncle 1–2 cm, pedicels 2–4 mm, both ferrugineous-tomentose, bracts 2–3 × 1.5 mm, ovate or narrowly so; sepals 0.4–0.6 cm × 2–3 mm, ovate, acute, appressed-tomentose, squamellae ca. 1 mm long, fimbriate at the apex; corolla salverform, cream, strigose-velutinous, tube 5–6 × 1.5–2 mm diam. at the orifice, epistaminal appendages 1.8–2 mm, exserted, glabrous, callus conspicuous, lobes 4–5 × 3 mm, obovate; stamens exserted, filaments ca. 1.5 mm, glabrous, anthers 4 mm, glabrous, ovary ca. 1.5 mm, glabrous, style 4–5 mm; disk of separated glands, deltoid, ca. 1 mm.

Follicles 28–31 cm × 4–5 mm, linear, velutinous-tomentose; immature seeds 2.2–2.4 × 1.5 cm, rugose, coma 2–2.4 cm, tan.

Distribution. Known only from the type, collected in central Panama.

Phenology. Flowers and fruits are borne in January.

This species is easy to distinguish by its short flowers, with reduced pedicels and well-developed epistaminal appendages.

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Carex pigra, a New Species of *Carex* Section *Griseae* (Cyperaceae) from the Southeastern United States of America

Robert F. C. Naczi

Department of Biological Sciences, Northern Kentucky University, Highland Heights, Kentucky 41099-0400, U.S.A.

ABSTRACT. *Carex pigra* is described as new from Alabama, Florida, Georgia, Mississippi, North Carolina, South Carolina, Tennessee, and Virginia. Loosely and few-flowered pistillate spikes, long staminate spike peduncles, perigynia usually 3.9–4.5 mm long, and achenes occupying most of the space within the perigynia are among the characters distinguishing *C. pigra* from what are probably its closest relatives, *C. flaccosperma* and *C. glaucodea*. *Carex pigra* occurs mostly in moist to wet deciduous forests.

Carex sect. *Griseae* (L. H. Bailey) Kükenthal is a group of sedges endemic to eastern North America that is most diverse in mesic deciduous forests of the southeastern United States. Numerous (usually 40 or more), longitudinal sclerenchyma traces ("nerves" of earlier authors, e.g., Fernald, 1950; Gleason & Cronquist, 1991) that are impressed in living and dried perigynia are apomorphies diagnosing the section. Additional characters shared by members of section *Griseae*, though not unique to them, include glabrous leaf and bract blades, long-sheathing lower bracts, usually unisexual spikes with only the terminal one staminate, and glabrous perigynia with entire apices. This section (including sect. *Oligocarpae* (Carey) Mackenzie) contains twenty-one species, one of which I describe here as new. This new species is more widespread and frequent than any of the six other species recently described as new in section *Griseae*, which are narrow endemics or rare (Bryson et al., 1987; Kral et al., 1987; Bridges & Orzell, 1989; Naczi, 1989, 1993).

Carex pigra Naczi, sp. nov. TYPE: U.S.A. Mississippi: Lowndes County, 1.8 mi. W of Mayhew, ca. 0.3 mi. E of Oktibbeha County border, ca. 0.5 mi. W of junction of routes 45 Alternate and Old 82, 15 May 1989, *Naczi 2174A & Bryson* (holotype, MICH; isotypes, KNK, NCU, NY, US, herb. Bryson). Figure 1.

A *Carex flaccosperma* spicis femineis angustioribus, perigyniis brevioribus et ascendentioribus, perigyniis (1.7–)1.8–2.0plo longioribus quam corporibus acheniorum, stipitibus acheniorum brevioribus, rostris acheniorum flexis differt; a *Carex glaucodea* perigyniis paucioribus, laxioribus, longioribus, et (1.9–)2.1–2.6(–2.8)plo longioribus quam latioribus differt; a speciebus ambabus pedunculis spicarum terminalium longioribus differt.

Perennial herb, densely caespitose. Rhizomes short, 0.2–6 mm long between shoots or branches of the rhizomes, with internodes 0.2–4.2 mm long, 1.2–2.8 mm thick, covered with cataphylls 2–5 mm long. Shoot bases usually surrounded by cataphylls but not by bases of old leaves, stramineous. Reproductive shoots 10–51 cm tall, erect to spreading, elongating slightly in fruit; culms 0.6–1.3 mm wide at mid-height, smooth throughout, obtusely trigonous. Cataphylls glabrous, stramineous to whitish, multicostate. Leaves of reproductive shoots 2–5, arising in basal 0.004–0.13 of culms, the longest 0.37–0.85 times as long as culms; blades 4.8–20 cm long, 3.8–12.3 mm wide, the widest 6.1–12.3 mm wide, glaucous, flat to barely plicate, margins smooth or antrorsely scaberulous, adaxial surface smooth or sparsely antrorsely scaberulous on main veins, abaxial surface smooth; leaf sheaths 1.7–4.7 cm long, loose, glabrous, glaucous with bases whitish or stramineous; adaxial face of sheaths with hyaline and glabrous band, hyaline band with apex slightly concave to slightly convex; ligules 3.8–6.8 mm long, lingulate with apex obtuse. Vegetative shoots 13–33 cm tall, 0.50–0.82 times as tall as culms; leaves 4–6, similar to those of culms except blades 6.3–27 cm long; pseudoculms 2.1–6.9 cm tall, 3.2–5.2 mm wide, 0.15–0.22 of vegetative shoot height. Infructescences 8.7–47 cm long, 0.71–0.93 of culm height, usually with the upper 2–3 spikes overlapping, rarely with all spikes separate; the uppermost lateral spikes 0.3–11.4 cm distant; the lower spikes separate, 4.0–18 cm distant; lowest bract with blade 6.2–18 cm long and 0.31–0.70 times as long as culm, sheath 0.9–4.7 cm long, adaxial face of sheath with glabrous and hyaline band occupying full length or a portion of sheath, hyaline band with apex slightly convex and elongated 0.2–2.2 mm above sheath apex, sheath glabrous abaxially, ligule (3.0–)5.2–10.2 mm long;

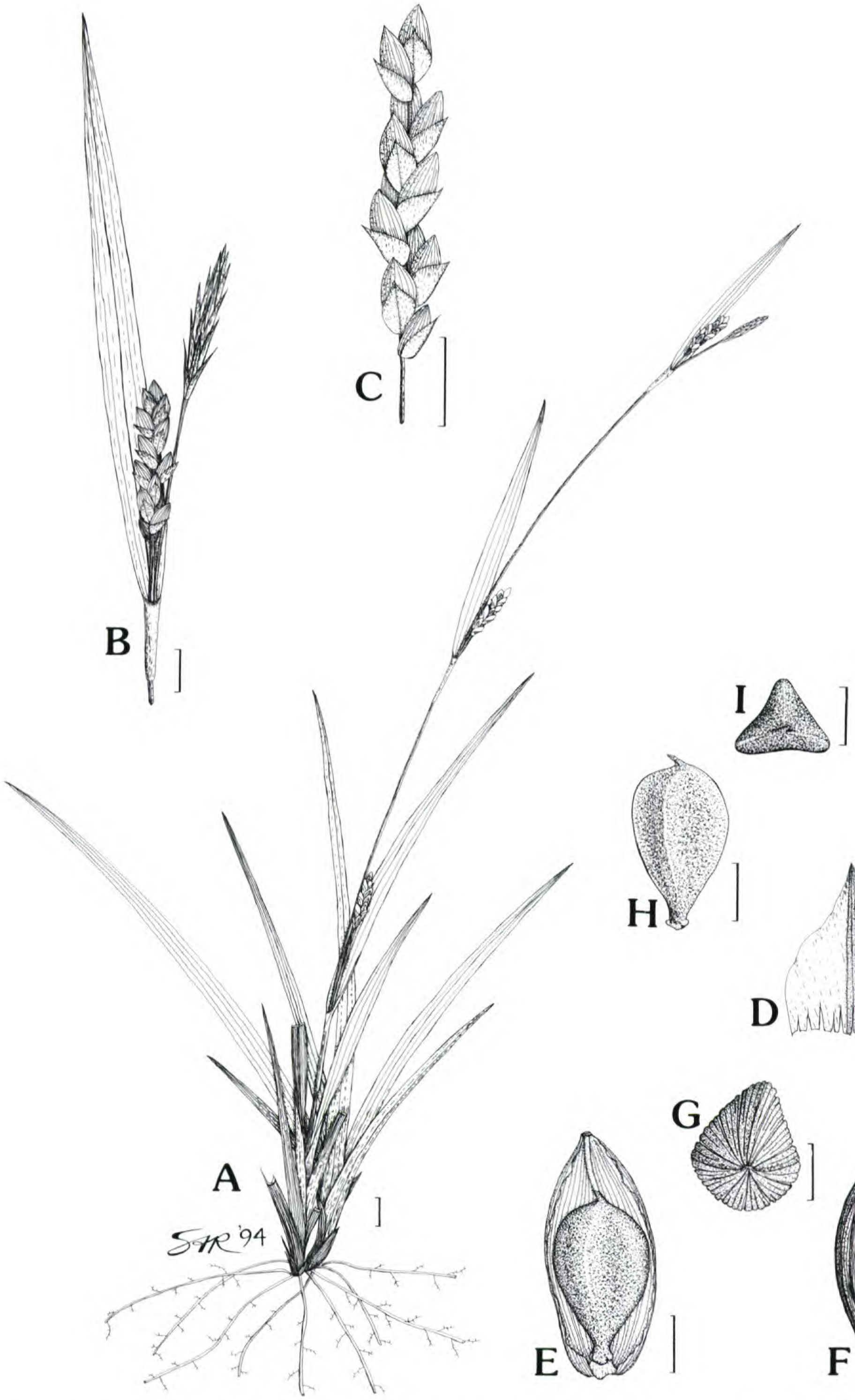

Figure 1. *Carex pigra* Naczi. —A. Habit. —B. Upper portion of infructescence. —C. Pistillate spike. —D. Pistillate scale. —E. Perigynium, side view, dissected to reveal achene. —F. Perigynium, side view. —G. Perigynium, top view. —H. Achene, side view. —I. Achene, top view. Bar equals 1 cm in A, 5 mm in B–C, and 1 mm in D–I. Drawn from the holotype.

bract blade of uppermost lateral spike 1.3–9.1 cm long and slightly shorter than terminal spike to much exceeding terminal spike, sheath 1.4–8.8 mm long and glabrous; uppermost bract scale-like, sheathless, body 3.2–6.7 mm long and awn 0–13.6 mm long. Spikes (3–)4–6, simple, single at nodes, erect; terminal spike 0.6–3.2 cm long, the longest 0.9–3.2 cm long, 1.8–3.3 mm wide, entirely staminate, 8–93-flowered, on erect and smooth peduncle 1.5–37(–62) mm long, usually overlapping uppermost lateral spike and slightly exceeding it or slightly exceeded by it, rarely exceeding uppermost lateral spike and separate from it; lowest spike 0.8–2.3 cm long, 3.3–4.6 mm wide, entirely pistillate, 5–16-flowered, the perigynia spirally and loosely imbricate, the internode between the lowest perigynia 0.6–3.3 mm long, on erect, smooth peduncle 1.8–11 cm long; upper lateral spikes 0.8–3.2 cm long, 4.0–6.1(–6.8) mm wide, entirely pistillate and 9–25(–28)-flowered, the perigynia spirally and loosely imbricate, spike length (in mm)/number of flowers ratio (0.97–)1.0–1.3(–1.6), on erect and smooth peduncles 0.4–8.4 cm long. Staminate scales (3.9–)4.5–5.3 mm long, 1.6–2.0 mm wide, narrowly elliptic to elliptic, acute to acuminate, awnless, center green and 1-nerved, margins hyaline and whitish or whitish with ferrugineous speckles and streaks. Pistillate scales 1.9–3.2(–4.5) mm long, 1.3–2.2 mm wide; body (1.7–)1.9–2.4(–2.6) mm long, (0.40–)0.45–0.59(–0.67) times as long as perigynium, broadly ovate or ovate, awnless or with midrib prolonged as sparsely antrorsely scaberulous awn 0.1–0.9(–1.9) mm long, center green and 1–3(–6)-nerved, margins entire, hyaline, pale ferrugineous to whitish. Anthers 3, 1.6–2.6 mm long. Styles jointed with achenes, portion distal to achene withering with age, portion proximal to achene persistent and becoming achene beak; base 0.15–0.20 mm wide. Stigmas 3, 1.0–1.6 mm long, withering with age. Perigynia (3.7–)3.9–4.5(–4.7) mm long, 1.5–2.2 mm wide, (1.9–)2.1–2.6(–2.8) times as long as wide, (1.7–)1.8–2.0 times as long as achene bodies, ascending, obtusely triangular in cross section, faces slightly convex to flat, nerves shallowly impressed and 42–56, glabrous, glaucous to red-brown, narrowly ovoid or lance-ovoid, very gradually tapered from widest point to broad and truncate base, gradually tapered to straight and subacute or acute apex, beakless or with minute beak; beaks 0–0.2(–0.4) mm long, 0–0.05(–0.11) of perigynium length, straight, smooth, entire. Achenes 2.6–3.1 mm long, (1.3–)1.4–1.6 mm wide, loosely enveloped by perigynia, obovoid, obtusely trigonous, faces slightly concave to flat, brown, basally abruptly contracted to stipe, apically abruptly contracted to beak; stipe 0.1–0.3(–0.5) mm long, usually vertical; body (2.0–)2.1–2.4(–2.5) mm long, with widest point 0.7–1.1 mm from body apex; beak (0.1–)0.2–0.4(–0.5) mm long, bent (0–)30–90° from vertical.

Carex pigra appears to be most closely related to *C. flaccosperma* Dewey and *C. glaucodea* Tuckerman. All of these species share glaucous and relatively wide foliage (widest leaf (5.1–)6.2–11.1(–13.5) mm wide), as well as awnless or short-awned pistillate scales (awn 0–0.9(–1.9) mm long). The rest of the species of *Carex* sect. *Griseae* have foliage that is green (except *C. brysonii* Naczi, which has glaucescent foliage) and narrower (widest leaf 2.0–6.8(–9.1) mm wide), as well as long-awned pistillate scales (awn (0.2–)1.1–8.3(–13.7) mm long).

Carex pigra differs from *C. flaccosperma* in having narrower pistillate spikes, shorter perigynia that spread less in the spikes, achene bodies that occupy more of the space within the perigynia, shorter achene stipes, and bent achene beaks. Relative to *C. glaucodea*, *C. pigra* has fewer and longer perigynia with higher length/width ratios that are more loosely overlapping in each spike. In addition, *C. pigra* has longer staminate spike peduncles than either *C. flaccosperma* or *C. glaucodea*. The key below highlights the distinctive features of *C. pigra*. Mature, complete, and ample specimens are necessary for identification. Depauperate specimens are difficult to identify. Because ranges of measurements of key characters overlap somewhat among the species, often one must consider all key characters when attempting to identify *C. pigra*, *C. flaccosperma*, and *C. glaucodea*. Despite this overlap, I have seen no specimens that simultaneously overlap in more than one or two key characters between *C. pigra* and *C. flaccosperma* or *C. pigra* and *C. glaucodea*.

Carex pigra usually inhabits moist to wet deciduous forests, forest openings, and forest edges. Occasionally, it grows in seasonally moist to wet prairies, especially in the western part of its range. Its substrates are acidic to slightly alkaline clays and loams. *Carex pigra* ranges from southeastern Virginia west to eastern and southern Tennessee and south to northern Florida, southern Alabama, and northeastern Mississippi. It occurs in several physiographic provinces, but most of its range lies in the Piedmont and the Coastal Plain. Range-wide, it is an infrequent species. It appears to be most common in central North Carolina. The paratypes cited below are a representative sample of 170 records (about 250 total specimens) I have studied. Flowering plant species that frequently associate with *C. pigra* include *Acer rubrum* L., *C. blanda* Dewey,

C. amphibola var. *amphibola* sensu Fernald (1950), *Cornus florida* L., and *Liquidambar styraciflua* L. Nearly throughout its range, *Carex pigra* is sympatric with *C. flaccosperma*. *Carex pigra* tends to grow in slightly drier soils than *C. flaccosperma*. Nevertheless, plants of the two species occasionally grow syntopically. In such situations, *C. flaccosperma* usually grows low on a floodplain, with *C. pigra* low on a slope adjacent to the floodplain or on the upper portion of the floodplain. I have never detected intermediates or hybrids between *C. pigra* and *C. flaccosperma*. *Carex pigra* is sympatric with *C. glaucodea* only at the northern and western edges of the range of the former, the bulk of the range of *C. pigra* being more southeastern than that of *C. glaucodea*. Rarely, plants of these two species do grow syntopically. In localities of syntopy, *C. pigra* tends to grow in moister soils than *C. glaucodea*. As with *C. flaccosperma*, I have seen neither intermediates nor hybrids between *C. pigra* and *C. glaucodea*.

Botanists have collected *C. pigra* since 1868 (*Mohr s.n.* in Montgomery County, Alabama), usually identifying it as *C. flaccosperma*. The fact that *C. pigra* is intermediate in perigynium length between *C. flaccosperma* and *C. glaucodea* probably accounts for why earlier botanists did not recognize the uniqueness of *C. pigra*. This intermediacy probably also accounts for earlier confusion between *C. flaccosperma* and *C. glaucodea*, which often resulted in lumping of the two species (e.g., Radford et al., 1968; Godfrey & Wooten, 1979; Gleason & Cronquist, 1991). Evidence from morphology, ecology, geography, natural hybridization, and cytology suggests that both *C. flaccosperma* and *C. glaucodea* deserve specific status (Naczi, 1991).

Because *Carex pigra* produces fewer pistillate flowers per spike and more loosely flowered spikes than *C. glaucodea*, I have named it *pigra*, meaning "lazy" or "slow."

KEY TO *CAREX PIGRA* AND RELATED SPECIES

1a. Perigynia (4.0–)4.2–5.5(–6.0) mm long, (2.0–)2.1–2.7 times as long as achene bodies, spreading to ascending; achene stipes (0.2–)0.3–0.5(–0.6) mm long; pistillate spikes (5.0–)5.9–8.0(–9.6) mm wide; achene beaks vertical to bent slightly, usually bent 0–30° from vertical . . . . . *C. flaccosperma*

1b. Perigynia 3.2–4.5(–4.7) mm long, 1.6–2.0 times as long as achene bodies, usually ascending; achene stipes 0.05–0.3(–0.5) mm long; pistillate spikes (3.3–)4.2–6.1(–7.3) mm wide; achene beaks bent slightly to recurved, usually bent 30–90° from vertical.

2a. Perigynia 3.2–4.0(–4.1) mm long, (1.5–)1.8–2.3(–2.5) times as long as wide; longest pistillate spike (14–)19–45(–65)-flowered, densely flowered with spike length (in mm)/number of flowers ratio (0.56–)0.67–1.1(–1.3); longest peduncle of staminate spike 0.5–15(–31) mm long . . . . . *C. glaucodea*

2b. Perigynia (3.7–)3.9–4.5(–4.7) mm long, (1.9–)2.1–2.6(–2.8) times as long as wide; longest pistillate spike 11–25(–28)-flowered, rather loosely flowered with spike length (in mm)/number of flowers ratio (0.97–)1.0–1.3(–1.6); longest peduncle of staminate spike (1.5–)7.5–37(–62) mm long . . . . . *C. pigra*

Paratypes. U.S.A. **Alabama:** Bibb County, 6 mi. SE of Centerville, 3 May 1988, *Bryson 8523* (herb. Bryson); Dallas County, ca. 3 mi. SW of Carlowville, 25 Apr. 1927, *Harper 12* (NY, US); Franklin County, ca. 2 mi. N of Russellville, 17 May 1968, *Kral 30580* (SMU, VDB); Lawrence County, ca. 10 mi. SW of Wren, along Borden Creek, 25 May 1993, *Naczi 3109 et al.* (AUA, KNK, MICH, NCU, NY, UNA, US, VDB, herb. Bryson); Madison County, E of Huntsville, Monte Sano Mtn., 25 May 1986, *Bryson 4390* (herb. Bryson); Marengo County, ca. 9 mi. SE of Demopolis, 17 May 1989, *Naczi 2189A* (MICH); Montgomery County, Pintlalla Creek, 1 May 1868, *Mohr s.n.* (ALU); Morgan County, 2 mi. N of Falkville, 5 May 1971, *Kral 42583* (VDB); St. Clair County, S side of Ashville, 29 Apr. 1972, *Kral 45889B* (VDB); Sumter County, near Emelle, 26 Apr. 1934, *Harper 3187* (BH, GH, MO, NY, US). **Florida:** Gadsden County, Chattahoochee, Apalachicola River landing, 14 Apr. 1982, *Gholson 9535 & Manhart* (FLAS); Jackson County, Three Rivers State Park, near Lake Seminole, 30 Apr. 1980, *Gholson 8284* (FLAS). **Georgia:** Baker County, along Flint River, Ichauway Plantation, 4 Apr. 1986, *Gholson 11587 & Jackson* (FLAS, herb. Bryson); Catoosa County, 1.9 mi. E of Ft. Oglethorpe, 19 May 1951, *Duncan 12427* (GA, NY, TENN, UNA); Decatur County, 1 mi. N of Chattahoochee, along Flint River, 14 Apr. 1947, *Thorne 3095 & Muenscher* (CU, F, GA, GEO, GH, NY, US); Elbert County, near Anthony Shoals of Broad River, 25 Apr. 1981, *Manhart 231* (herb. Bryson); Floyd County, Mount Berry, 27 Apr. 1938, *Jones 503* (VDB); Johnson County, N of Wrightsville, along Cedar Creek, 16 June 1902, *Harper 1337* (GH, MO, NY, US). **Mississippi:** Benton County, 0.1 mi. W of Benton/Union County line, N of US Hwy. 78, 18 May 1990, *Bryson 9972* (MICH, herb. Bryson); Chickasaw County, ca. 3 mi. N of Houston, along Houlka Creek, 23 Apr. 1971, *McDaniel 15005 & Childress* (herb. Bryson); Clay County, 3 mi. SW of Montpelier, 5 May 1955, *Ray 4424* (USF); Kemper County, ca. 4 mi. N of Scooba, 15 May 1989, *Naczi 2184 & Bryson* (MICH); Lee County, 5 mi. SW of Tupelo, 1 May 1982, *Bryson 3228* (TENN, WARM, herb. Bryson); Monroe County, W of Amory, 17 May 1990, *Bryson 9883 et al.* (herb. Bryson); Oktibbeha County, near Starkville, 30 Apr. 1898, *Tracy 32* (BH); Pontotoc County, ca. 10 mi. E of Pontotoc, 19 May 1990, *Naczi 2436* (KNK, MICH, US, herb. Bryson); Winston County, 2.5 mi. N of Louisville, 3 May 1973, *Bryson 146* (herb. Bryson). **North Carolina:** [no locality data other than state], 12 May 1874, *Canby s.n.* (CM); Alamance County, Saxapahaw, near Haw River, 27 May 1960, *Radford 43046* (NCU); Bertie County, WNW of Woodard, 29 May 1958, *Ahles 41320 & Duke* (FLAS); Caswell County, 1 mi. N of Frogsboro, 4 June 1960, *Radford 43257* (NCU); Chatham County, near Mt. Carmel Church-Farrington Road, along Fox Creek, 7 May 1949, *Radford 4058* (NCU); Chowan Coun-

ty, 2.5 mi. SE of Edenton, *Ahles 39790 & Ashworth* (NCU); Cumberland County, 1 mi. NW of Wade, Cape Fear River, 26 May 1961, *Radford 43688* (DUR, NCU); Davidson County, S side Yadkin River at rte. 49, 5 May 1950, *Blomquist 14916 et al.* (DUKE); Durham County, 7 mi. S of Durham, 22 May 1956, *Bell 2714* (CM, NCU, SMU); Gates County, NW of Roduco, 2.8 mi. NNE of jct. US 13-158 on US 13, 9 May 1958, *Ahles 40402 & Ashworth* (NY, VDB); Granville County, along Tar River, 16 May 1935, *Correll 608* (GA); Guilford County, N of Gibsonville, 3 June 1958, *Bell 12459* (VDB); Hyde County, 4.5 mi. N of Scranton, 18 May 1958, *Radford 33683* (MIN, SIU); Lee County, ca. 4 mi. NE of Colon, 20 May 1989, *Naczi 2207* (KNK, MICH, herb. Bryson); Montgomery County, Abner, 26 May 1988, *Naczi 1979* (KNK, MICH); Moore County, 2 mi. SSE of Glendon, near McLendons Creek, 11 June 1960, *Radford 43367* (NCU); Orange County, Chapel Hill, 7 May 1897, *Ashe 2107* (NCU); Randolph County, Liberty, 27 May 1958, *Bell 12001* (NCU); Rowan County, near Faith, 27 May 1911, *Heller 10272* (MO); Stanly County, 2.9 mi. ENE of Albemarle, 3 May 1956, *Ahles 11865 & Radford* (NCU); Stokes County, 4 mi. W of Walnut Cove, 4 June 1958, *Radford 34710* (NCU). **South Carolina:** Barnwell County, Savannah River Operations Area of Atomic Energy Commission, 4 May 1953, *Batson s.n. & Kelley* (NCU); Berkeley County, ca. 2 mi. SE of Witherbee, Francis Marion Natl. Forest, Santee Experimental Forest, 25 Apr. 1992, *Hill 22985 & Meyers* (MICH); Cherokee County, 3.8 mi. SW of Blacksburg, 26 May 1977, *Kral 60154* (VDB); Greenwood County, ca. 0.4 mi. E of Abbeville County line, along rte. 284, 16 May 1986, *Nelson 4711* (FLAS); Kershaw County, ca. 8 mi. NW of Camden, 19 May 1989, *Naczi 2202* (KNK, MICH, herb. Bryson); McCormick County, ca. 11 mi. ESE of McCormick, 13 May 1992, *Horn 5138 & Bouknight* (MICH); Newberry County, 1.3 mi. SW of Chappells, 11 May 1957, *Bell 6979* (NCU); York County, ca. 3 mi. NW of Bethany, 3 May 1989, *Naczi 2079* (MICH). **Tennessee:** Anderson County, 0.5 mi. E of Oliver Springs, 15 May 1966, *Rogers 44744 & Rogers* (SMU, TENN, VDB); Franklin County, Huntland, 3 May 1939, *Svenson 10037* (BH, GH, MO, NY, TENN); Knox County, 4 mi. SE of Knoxville, 31 May 1980, *DeSelm s.n.* (herb. Bryson); McNairy County, N of Middleton, along Porters Creek, 23 Apr. 1949, *Sharp 10240 et al.* (TENN); Sevier County, W of Sevierville, 28 Apr. 1946, *Shanks 1864* (GH, NLU, TENN). **Virginia:** Charles City County, 3 mi. S of Cherry Hill, 14 June 1950, *Mikula 4944* (FARM); Greensville County, E of Emporia, by Metcalf Branch, 11 June 1938, *Fernald & Long 8157* (GH); Nottoway County, 4 mi. SE of Blackstone, 20 May 1975, *Harvill & Harvill 32999* (FARM); Prince George County, SE of Prince George, 20 June 1936, *Fernald et al. 5683* (GH); Princess Anne County, Little Neck, 17 June 1935, *Fernald et al. 4591* (GH, PENN); Sussex County, E of Stony Creek, near Nottoway River, 9 June 1938, *Fernald & Long 8156* (GH).

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A New Species of *Andira* (Leguminosae, Papilionoideae) from the Venezuelan Guayana

R. Toby Pennington
Royal Botanic Garden Edinburgh, 20a Inverleith Row, Edinburgh EH3 5LR, Scotland, U.K.

Gerardo Aymard and Nidia Cuello
Herbario Universitario PORT, UNELLEZ-Guanare, Mesa de Cavacas 3323,
Edo. Portuguesa, Venezuela.
(Present address: Missouri Botanical Garden, P.O. Box 299, St. Louis,
Missouri 63166, U.S.A.)

ABSTRACT. A new species of *Andira* from Estado Bolívar, Venezuela, is described. *Andira tervequinata* R. T. Pennington, G. Aymard & N. Cuello is clearly distinct from all other *Andira* species, although it might be confused with *A. trifoliolata* Ducke because specimens often have some trifoliolate leaves.

While preparing the account of *Andira* for the *Flora of the Venezuelan Guayana*, we found four specimens from two localities in Estado Bolívar representing a distinctive new species. The region covered by the *Flora of the Venezuelan Guayana* is one of particular interest for *Andira*. Two specimens (*P. E. Berry et al. 5102* and *A. Gentry & S. Tillett 10889*) from Estado Amazonas may also represent new species, but unfortunately the material currently available is inadequate to confidently describe them. New collections are needed from the white sand savanna and forest habitat, where these specimens were collected. These potential new species, the new species described in this paper, and new species of *Andira* found in Amazonian Ecuador and in the Brazilian State of Amapá (R. T. Pennington, unpublished data) together indicate that *Andira* has undergone considerable diversification around the fringes of Amazonia.

Andira tervequinata R. T. Pennington, G. Aymard & N. Cuello, sp. nov. TYPE: Venezuela. Estado Bolívar: Distrito Heres, west bank of Río Trueno Alto, 35 km W of Chiguao, high plateau, ecotone between gallery forest and savanna, 06°07′N, 63°22′W, 480 m, 23 Mar. 1985, *Huber 10345* (holotype, NY; isotypes, AAU, E, HBG, INPA, K, M, MO, MY, MYF, P, PORT, RB, US, VEN). Figure 1A–M.

Species bene distincta, quae fortasse cum *A. trifoliolata* Ducke confusa possit, sed aliquae folia quinquefoliolata habeat (in *A. trifoliolata* omnia folia semper trifoliolata sunt), foliolis infra indumento pilorum brevium adpressorum, apicibus retusis aliquando emarginatis cum nervo primario canaliculato (in *A. trifoliolata* foliolis infra glabris cum apicibus acuminatis, nervo primario planiusculo) differt.

Small tree or shrub to 7 m tall; twigs very dark brown with raised elongated lenticels, outer bark very dark brown (almost black), this layer often flaking to reveal red-brown beneath, sparsely red-brown ± appressed pubescent, glabrescent in age. Stipules to 7 mm long, narrow, caducous, red-brown appressed pubescent; leaves imparipinnate; leaf axis 4–16 cm long; rachis canaliculate, longitudinally ridged, dark brown flaking to reveal red-brown beneath, glabrous; stipels tiny; petiolules 3–8 mm long, sparsely appressed pubescent; leaflets in 1–2 pairs, coriaceous, 3.5–11× 2–5 cm, wide elliptic to wide obovate, glabrous above, with short, appressed, pale hairs beneath; base obtuse; apex obtuse to rounded, generally retuse, occasionally emarginate; primary vein channeled above, raised beneath; secondary veins 6–7 pairs, plane above, very slightly raised beneath, pattern eucamptodromous becoming brochidodromous. Panicles axillary and terminal, 10–12 cm long, sparsely red-brown appressed pubescent; bracts 2 mm long, caducous; pedicels 1–1.5 mm long; bracteoles not seen (presumably small and early caducous). Flowers pale purplish white, 9 mm long. Calyx 4 mm long, glabrous except for a few scattered hairs on the lobes; lobes 1 mm long, obtuse with pointed acumens. Standard-blade 6 × 8 mm, claw 3 mm; wing 6 × 3 mm, claw 4 mm; keel 5 × 3 mm, claw 4 mm. Stamens 6–7 mm long, the filaments united for 4–5 mm, free for 1–2 mm. Gynoecium 9–9.5 mm long, the upper surface and distal end of the lower surface of the ovary with sparse hairs; stipe

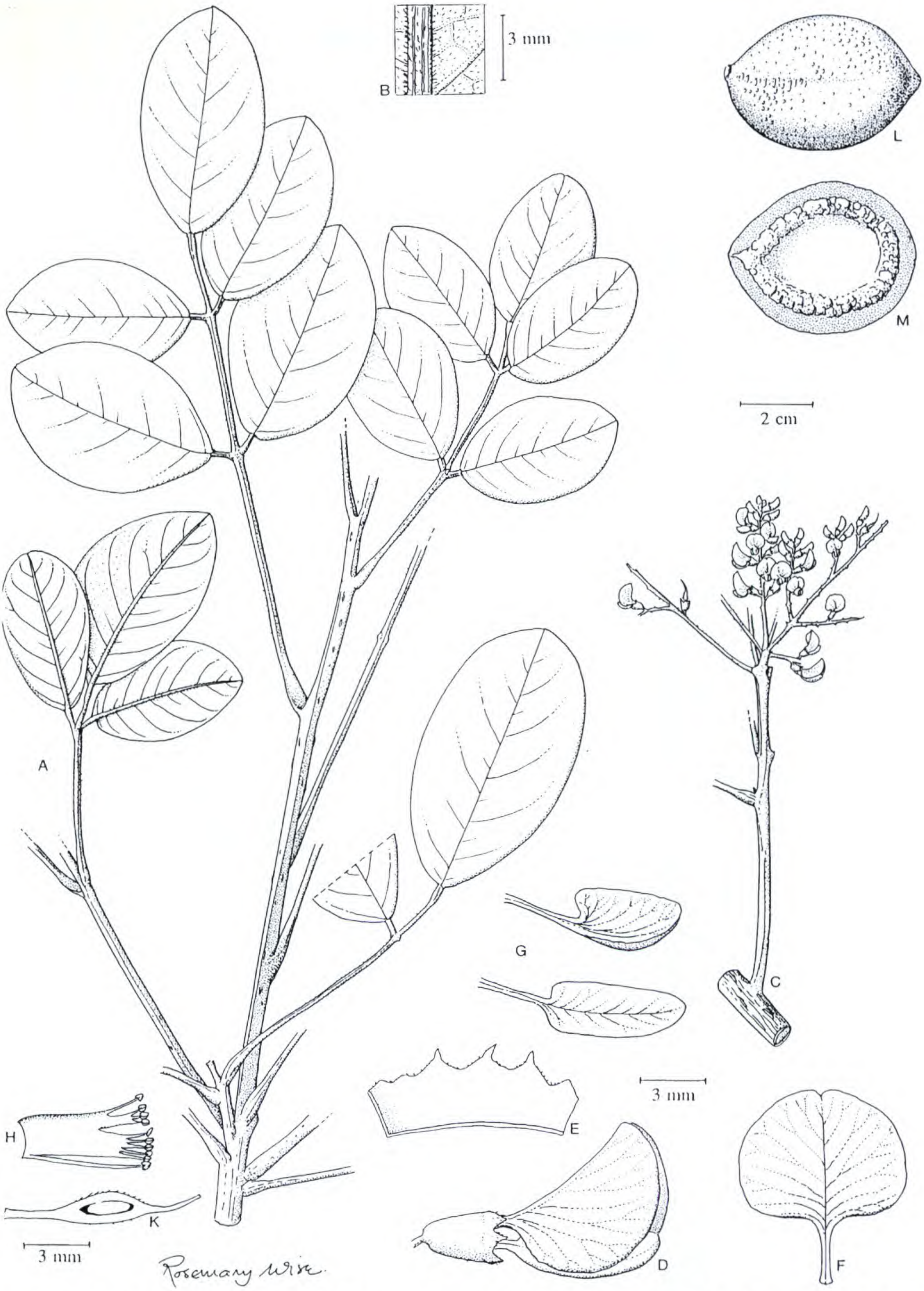

Figure 1. A–M. *Andira tervequinata* R. T. Pennington, G. Aymard & N. Cuello. —A. Habit. —B. Leaflet undersurface. —C. Inflorescence. —D. Flower. —E. Detail of calyx (inner surface). —F. Standard petal (inner surface). —G. Keel petal (above; inner surface) and wing petal (below; outer surface). —H. Androecium. —K. Gynoecium. —L. Fruit. —M. Fruit in section. Drawn from *Huber 10345* (flowering) and *Holst & Liesner 2798* (fruiting).

3.5–4 mm long; ovary 3 mm long; style 2.5 mm long; ovules 1. Fruits green or gray-green, drying dark brown to red-brown, the surface with pale, raised specks, ± globose, 5.5 cm long × 3.8 cm wide × 3.8 cm high; suture raised below, slightly raised above; stylar remnant minute or absent; mesocarp 3 mm thick in cross section, pale, amorphous (comprising parenchyma and patches of stone cells in microscopic section); endocarp 4–5 mm thick in cross section, hard, pale, amorphous (comprising stone cells in microscopic section); seed white.

Ecology and distribution. The species is known only from the former Distrito Heres and Distrito Piar in Estado Bolívar, Venezuela, at 350 to 500 m elevation. It has been collected in gallery forest, in shrub and tree islands in savanna dominated by *Trachypogon plumosus* Nees (G. Aymard, pers. obs.; this vegetation was on conglomerated sandstones), and in the ecotone between savanna and gallery forest. It has been recorded as flowering in March and possessing young and mature fruits in May.

Andira tervequinata is a most distinct species. The only other *Andira* species that has trifoliolate leaves is *A. trifoliolata,* which occurs in Colombia and Brazil, and in Venezuela has only been collected in Estado Amazonas. However, the leaves of *A. tervequinata* show several differences from those of *A. trifoliolata.* Diagnostic characters are the number of leaflets, the nature of the primary vein, the shape of the leaflet apex, and the indumentum on the leaflet undersurface. *Andira trifoliolata* has all leaves trifoliolate, whereas *A. tervequinata* has leaves with three to five leaflets. In *Andira trifoliolata* leaflets have a plane primary vein on their upper surfaces, whereas in *A. tervequinata* the primary vein is channeled. In *Andira trifoliolata* leaflets are acuminate at the apex, whereas in *A. tervequinata* the leaflet apex is retuse or emarginate. The leaflet undersurface is glabrous in *A. trifoliolata,* whereas in *A. tervequinata* it has an indumentum of short, appressed hairs. Although these diagnostic characters are vegetative, with the exception of leaf apex shape they are of considerable phylogenetic significance in *Andira* and have been included in cladistic data matrices (Pennington, in press; R. T. Pennington, unpublished data). They do not vary widely within individual species of *Andira* and are useful characters for species delimitation.

The species also differ in the size of the tree, leaflet shape, and fruit characters, although of these features none are wholly diagnostic. *Andira tervequinata* is a shrub or small tree to 7 m in height, whereas *A. trifoliolata* is generally a larger tree (to 20 m). Leaflets of *A. tervequinata* are often obovate, whereas this is a rare condition in *A. trifoliolata,* where the leaflets are generally elliptic. Further diagnostic characters may be found in the fruit, but fruiting collections of both species are few and poor. *Andira trifoliolata* generally has smaller fruits (to 3.5 cm long), and its fruit surface (when dry) is dark brown to almost black, while that of *A. tervequinata* is generally more red-brown with pale, raised specks.

Because *A. tervequinata* has a fruit with an endocarp composed of stone cells (B. Gemeinholzer and R. T. Pennington, unpublished data), it probably belongs to a clade of *Andira* species defined by this endocarp type (Pennington, 1995), which includes the central Amazonian species *A. unifoliolata* Ducke and *A. parviflora* Ducke, and *A. grandistipula* Amshoff, which is endemic to the Pakaraima mountains of Guyana.

The species is named for its characteristic leaves, which have either three or five leaflets.

Local Names. Pilón rebalsero.

Paratypes. VENEZUELA. **Bolívar:** Distrito Heres, A lo largo del Río El Trueno al N de la base del Guaiquinima Tepui, bosques húmedos primarios alternado con sabanas arboladas, 06°14′N, 63°27′W, 350 m, 20 May 1987, *Aymard 6147* (MO, NY, PORT); Distrito Piar, Río Aparamán at Kambay-merú rapids, SE base of Amaruay-tepui, W of Aparamán-tepui, E of Auyan-tepui, gallery forest, 05°55′N, 62°13′W, 500 m, 7 May 1986, *Holst & Liesner 2798* (E, MO); Distrito Piar, Río Aparamán, Kambay-merú rapids, ca. 3 km SE of SSE corner of Amaruay tepui, 05°55′N, 62°13′W, 500 m, 7 May 1986, *Liesner & Holst 20674* (E, MO).

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Xylosma longipedicellata (Flacourtiaceae), a New Species from Nicaragua

Amy Pool

Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. *Xylosma longipedicellata,* a new species from the dry upland forests of Nicaragua and neighboring Honduras, is described, and its relationships to other similar Central American species are discussed.

In the course of preparing a treatment of Flacourtiaceae for the Flora de Nicaragua, a new species of *Xylosma* was encountered and is here named and described.

Xylosma longipedicellata A. Pool, sp. nov. TYPE: Nicaragua. Departamento de Estelí: El Chayote; 13°16′N, 86°19′W, elevation 1100–1200 m, 31 July 1983 (fruit), *Pedro P. Moreno 21765* (holotype, MO; isotype, HNMN not seen).

Arbor parva vel frutex, deciduus exarmatus. Folii petiolis 9–18 mm longis. Flores ut videtur hermaphroditi staminibus ca. 15 vel feminei staminodiis 3–4 praediti. Fructus subglobosus pedicello usque ad 12–15 mm elongato supra basin 3—7 mm articulato insidens.

Small tree or shrub, 1–12 m, deciduous, without thorns, young stems minutely puberulent, soon glabrescent. Leaves obovate, oblanceolate or wide-elliptic, apex acute, obtuse or approaching rounded, then abruptly and briefly acuminate, base decurrent on petiole, 4.5–10.7 cm long, 2.5–5 cm wide, margin serrate-glandular, teeth often incurved with glands on lower surface, margins often slightly revolute over glands; petiole 9–18 mm long, glabrous. Flowers seemingly perfect or pistillate with staminodes, inflorescence appearing sessile and fasciculate in flower (noticeably pedunculate and subcorymbose in fruit), flowering from leafless axils (all leaves lost or some younger leaves present), 1 inflorescence per axil, 1–6 flowers per inflorescence, peduncle in fruit 2–6 mm long, densely puberulent, often totally obscured by bracts; bracts 1–2 mm long, imbricate at base of inflorescence and often present at point of articulation on pedicel, puberulent, villose-ciliate; pedicel 2.5–7 mm, expanding in fruit to 12–15 mm long, articulate at 1–3 mm from base (3–7 mm in fruit), densely puberulent; sepals yellow, 5 or 6, ovate, 1.2–2.3 mm long, 0.7–2 mm wide, internally densely hispid, externally puberulent (sometimes with apex villous), margin ciliate; stamens 13–15 in perfect flowers, 2–2.5 mm long, staminodes or bases of antherless filaments 3–4 in pistillate flowers; disk lobes fused to various degrees to form an irregularly lobed annulus 0.2–0.3 mm high, succulent; ovary glabrous, style 2–3-branched, branches divergent or not, 0.7 mm long, glabrous, stigmas many lobed. Fruit green or red, subglobose, 4–8 mm diam., glabrous, retaining style, stigmas, and disk, usually retaining some filaments, rarely retaining sepals; seeds 2–4, wedge-shaped or ovoidal, 4–4.5 mm long, 2–3.2 mm wide, glabrous.

Distribution. Xylosma longipedicellata has been collected in northwestern Nicaragua, in the departments of Estelí, Jinotega, and Madriz, and in south-central Honduras in the department of Francisco Morazán. This is an area that receives very limited precipitation: only 712 mm of annual rainfall is recorded at the weather station in Condega, with an average humidity of 69% (Fenzl, 1989). The collections are all from relatively high elevations, between 1000 and 1600 m. The substrate is the Tertiary volcanic, "Grupo Coyal, Superior" (Fenzl, 1989).

Phenology. Plants have been collected in flower and without leaves (or with only very young leaves) in January, February, and March; two were collected in flower with more mature leaves (but almost all from younger branchlets)—one in November and the other in January. This corresponds fairly well with the dry season, which runs from November to April (Fenzl, 1989). Plants have been collected in fruit with leaves in December, February, March, April, May, June, and July.

Paratypes. NICARAGUA. **Depto. Estelí:** Salto la Estanzuela, 13°01′N, 86°21′W, elevation 1000 m, 29 Mar. 1983 (perfect flowers), *P. P. Moreno 21138* (HNMN, MO); Salto la Estanzuela, 13°01′30″N, 86°21′W, elevation ca. 1100 m, 26 Nov. 1983 (perfect flowers), *A. Grijalva & M. V. Sandino 3300* (HNMN, MO); El Delirio, entrada al Zacatón, camino a Miraflor, 13°13′N, 86°14′W, elevation aprox. 1400 m, 26 Dec. 1982 (young fruits), *P. P. Moreno 19390* (HNMN, MO);

El Chayote, Fila la Mesa, 13°16′N, 86°19′W, elevation 1100–1250 m, 26 Dec. 1982 (pistillate flowers, young fruits), *P. P. Moreno 19973* (HNMN, MO); Cerro Quiabú, 13°07′N, 86°26′W, elevation ca. 1604 m, bosque enano, 14 Jan. 1981 (pistillate flowers), *P. P. Moreno 6044* (MO); Mesas Plan Helado, 21.5 km al E de Estelí, por el camino de Paso de León-Miraflor, 13°14′N, 86°15′W, elevation 1360–1380 m, 21 Feb. 1982, (fruits), *P. P. Moreno 15406* (HNMN, MO); Plan Helado, camino al la Laguna de Miraflor, yendo por Paso de León, 13°12′N, 86°14′W, elevation 1360–1380 m, 22 Apr. 1982 (fruits), *P. P. Moreno 16197* (HNMN, MO). **Depto. Madriz:** between La Sabana and Cusmapa, elevation 1350 m, 14 Mar. 1967 (fruits), *A. Molina R. 20599* (MO). **Depto. Jinotega:** Ocotillo near Sta. Lastenia, alt. 1550 m, 17 Jan. 1965 (flowers), *L. O. Williams et al. 27841* (F). HONDURAS. **Depto. Francisco Morazán:** vicinity of Suyapa-Tegucigalpa, 10 km on road to La Montañita, alt. 1000 m, 16 May 1976 (fruits), *A. Molina R. & A. R. Molina 31478* (MO); Los Artillos, alt. 1100 m, 19 June 1948 (fruits), *L. O. Williams & A. Molina R. 14332* (MO).

Relationships to similar species from Central America. Sleumer (1980) treated all *Xylosma* from Central America with seemingly perfect flowers and numerous stamens as one very variable species, *Xylosma intermedia* (Seemann) Triana & Planchon, and used this sexual condition to separate *Xylosma intermedia* in the lead couplet of his key to the Central American species. It is now possible to recognize three distinct species that (at least in some individuals) have perfect flowers with numerous stamens. An artificial key is therefore provided.

Artificial Key to Species of *Xylosma* from Central America with Perfect Flowers

1a. Petioles 9–18 mm long, leaf base decurrent; pedicels articulate above base, elongating to over 1 cm in fruit; stamens (or staminodes) 3–15 . . . . . *X. longipedicellata*

1b. Petioles 4–10 mm long, leaf base acute, obtuse or rounded; pedicels articulate at base, 1–6 mm long in fruit; stamens 20–50.

2a. Flowers appearing sessile (in fruit: rachis elongating to 0.5–1 cm, pedicel to 1–2 mm), rachis golden tomentose; leaves with apex acute or obtuse (rarely acuminate) . . . . . *X. horrida* J. Rose

2b. Inflorescences racemose, in flower and fruit rachis 0.5–2 cm long, pedicel 4–6 mm, rachis puberulent; leaves with apex long-acuminate . . . . . *X. intermedia*

The pistillate flowers of *Xylosma longipedicellata* that possess a few staminodes would, following Sleumer (1980), be identified as *Xylosma flexuosa* (Kunth) Hemsley, and two specimens of *Xylosma longipedicellata* (*L. O. Williams & A. Molina R. 14332* and *A. Molina R. 20599*) were cited as *X. flexuosa* by Sleumer. *Xylosma longipedicellata* can be separated from *X. flexuosa* as follows: *X. longipedicellata*—unarmed, petioles 1–2 cm long, fruiting pedicels 12–15 mm long, articulate 3–7 mm from base; *X. flexuosa*—often with trunk or branch thorns, petioles 0.5 cm or less, fruiting pedicels 2.5–7 mm long, articulate at base.

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The Genus *Microrphium* (Gentianaceae) in the Philippines

Jacinto C. Regalado, Jr. and Djaja D. Soejarto

Department of Botany, Field Museum of Natural History, Roosevelt Road at Lake Shore Drive, Chicago, Illinois 60605, U.S.A., and Program for Collaborative Research in the Pharmaceutical Sciences, Department of Medicinal Chemistry and Pharmacognosy, College of Pharmacy, University of Illinois at Chicago, Chicago, Illinois 60612, U.S.A.

ABSTRACT. Recent plant collecting and exploration in Palawan, Philippines, led to the rediscovery of a *Microrphium* (Gentianaceae) species that had not been validly published. The Palawan species, *M. elmerianum*, extends the distribution range of the genus, which is known previously from the Malay Peninsula and Thailand. The biogeographic significance of this finding, as well as its significance to the conservation needs of Palawan's unique plant diversity, are briefly discussed.

Recent plant collecting and exploration of the island of Palawan in the Philippines have contributed substantially to advancing our botanical and biogeographic knowledge of the flora of this island (Podzorski, 1985; Regalado et al., 1995; Soejarto et al., 1989, 1996b). The last period of exploration was conducted from 1987 to this date: on the one hand by the University of Illinois at Chicago, under the auspices of the United States National Cancer Institute, as part of an anticancer and anti-AIDS plant screening program (Soejarto, 1993; Soejarto, 1995; Soejarto et al., 1996a) with the cooperation of the Philippine National Herbarium, Manila (PNH), and on the other, by the Philippine Plant Inventory Project, funded by the U.S. National Science Foundation (Stone, 1991).

One interesting botanical rediscovery was a member of the gentian genus *Microrphium* on this island. A specimen belonging to this taxon was first collected in 1911 by an American botanist, A. D. E. Elmer, along Iwahig River and was not described until 1939. Elmer named it *Microrphium palawanense* and described the plant in English (Elmer, 1939). He did not provide a Latin description nor a diagnosis, hence the name is rendered invalid according to Article 36 of the International Code of Botanical Nomenclature (Greuter et al., 1994). The designated type specimen, *Elmer 12923* (holotype, PNH+), was distributed under the name of *Lysimachia* (Elmer, 1939). Duplicates of this specimen could not be found in spite of efforts of the first author (JCR) to locate them in major herbaria (A, F, GH, NY, US) where Elmer may have sent the duplicates. Merrill (1923) referred to the specimen *Elmer 12923* as representing an undescribed species of the genus; the only other species of the genus was previously known from the Malay Peninsula. Two collecting expeditions in Palawan by the second author (DDS) yielded specimens that match Elmer's species from the description. This discovery enabled us to describe Elmer's species with the requirements for valid publication.

Microrphium elmerianum Regalado & Soejarto, sp. nov. TYPE: Philippines. Palawan Island: Municipality of Puerto Princesa, Bacungan hills and slopes above Nagtabon beach, 9°51′N, 118°37′E, 50–100 m, 9 Apr. 1989, *Soejarto, Reynoso, Sagcal, Rutz & Edrada 6499* (holotype, F #2027197; isotypes, A, PNH). Figure 1.

Species *Microrphio pubescenti* C. B. Clarke affinis sed pubescentiis ochraceis haud cinereis, foliis sessilibus, inflorescentiis glabris differt.

Erect herb up to 60 cm tall. Stems terete, smooth, 5 mm diam.; branches apically yellowish brown puberulent, becoming glabrate toward the base. Leaves opposite, well scattered along the stem, subcoriaceous, sessile, elliptic, 5.5–6.5 cm long, 2.5–3.0 cm wide; apices obtuse to obtusely rounded; bases cuneate-attenuate, clasping the nodes, leaving annular scars after falling; margins entire and minutely ciliate; nerves 3 pairs, obliquely ascending, brown-puberulent beneath, reticulations absent; surfaces glabrate above, finely pubescent below. Inflorescences many-flowered, paniculiform cymes (thyrses), glabrous; rachises slender, terete, up to 30 cm long; floral bracts foliaceous, ovate, 10–20 mm long, 5–10 mm wide, paired, connate at the bases; bracteoles foliaceous, elliptic, 3–4 mm long, 2–3 mm wide, stiffly subtending each flower at the base of slender, terete pedicels 3–4 mm long. Flowers white; calyx ellipsoid, 5 mm long, 3 mm wide, glabrous, 2-lipped with wide slits on opposite sides down to the mid-

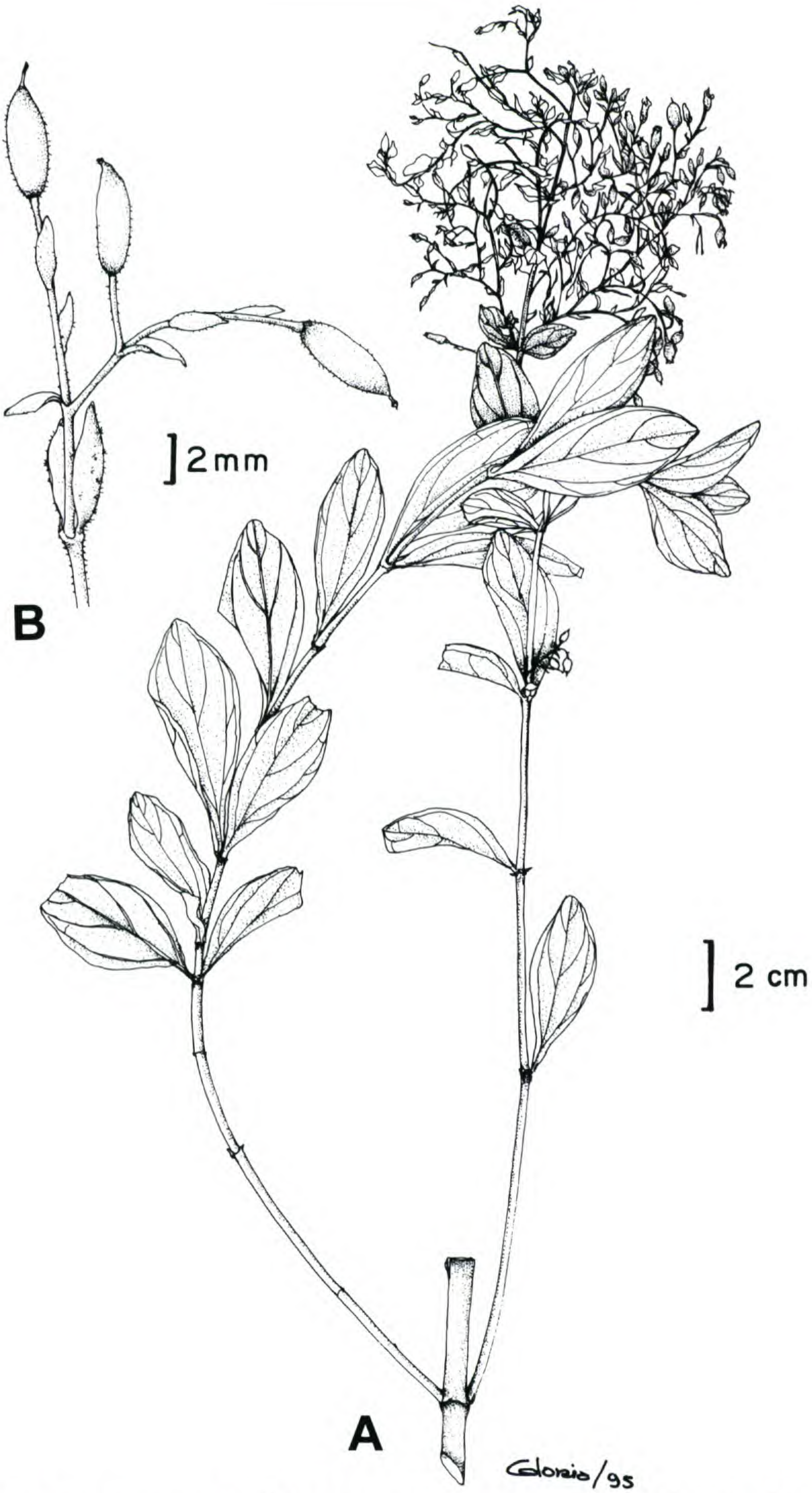

Figure 1. *Microrphium elmerianum* Regalado & Soejarto. —A. Segment of terminal branch with branchlets, leaves, and late stage inflorescence. —B. Immature fruits. Based on *Soejarto et al. 6499* (F).

dle, thickened by longitudinal ribs, the lobes 3–4, obtuse and apiculate at the tips, margins entire; corolla free from calyx, tubular, erect, 7–8 mm long, united at basal half, glabrous, the lobes 5, acute; stamens 5, inserted on middle of tube alternating with the lobes, the filaments flattened, linear 1–2 mm, the anthers 2 mm, tetrasporangiate, dithecal, basifixed, dehiscent by longitudinal slits;

ovary 2.5 mm, glabrous, surfaces rugulose, unilocular, multiovulate, placentation parietal; styles terete, 3 mm long, seemingly bifid; stigmas slightly thickened. Capsules subtended by persistent calyx and terminated by thickened styles, ellipsoid to obovoid, 4–5 mm long, 2–3 mm diam., dehiscent along longitudinal ribs; seeds numerous, irregularly shaped, rugulose, 0.25 mm wide, yellowish brown in color.

Field Notes. In low-statured forest on ultrabasic (ultramafic) soil, 50–100(–150) m elevation; semisucculent herb; calyx brownish orange; corolla white; fruits yellow.

Taxonomic Notes. The genus *Microrphium* was established by C. B. Clarke (1906) in his treatment of the Gentianaceae for the Flora of the Malay Peninsula. Clarke did not explain the etymology of the name, but we infer that *Microrphium* is derived from a combination of two Greek words, "mikros" meaning small, and "orphium" after Orpheus, a poet and musician in Greek mythology. *Orphium* E. Meyer is a monotypic gentian genus native to South Africa (Hyam & Pankhurst, 1995). Clarke distinguished *Microrphium* from other Malayan gentian genera by its short, thick, gray pubescence and its repeatedly branched habit. The Palawan species, *Microrphium elmerianum,* is distinguished from the Malayan species in having yellowish brown pubescence, sessile leaves, and glabrous inflorescences. The species is named in honor of A. D. E. Elmer (1870–1942) who made the first collection in Palawan and was first to recognize it as a new entity of *Microrphium.* Unfortunately, Elmer's species was not validly published because of reasons previously mentioned. To prevent confusion that may be created, the authors avoided adoption of the epithet published by Elmer.

Distribution and Biogeographic Significance. For many years, the genus *Microrphium* has been represented by one species, *M. pubescens* C. B. Clarke, which is known thus far from the type collection in Langkawi, a group of islands off the coast of Kedah District, Peninsular Malaysia (Ridley, 1923). Henderson (1939) listed the species in his catalog of the limestone flora of the Malay Peninsula and commented on its apparent abundance in the Langkawi islands. Later, the range of the species was extended to Peninsular Thailand (Ubolcholaket, 1987) when the species was collected in Phangnga, some 250 kilometers northwest of the Langkawi islands.

The discovery of a second species of *Microrphium* in Palawan is significant from the standpoint of biogeography. *Microrphium elmerianum* appears to be endemic to Palawan and apparently restricted to ultramafic substrates. Although the seeds of *Microrphium* are small, they are borne inside capsules that limit their chances for long-distance dispersal. The disjunct distribution of the two species of *Microrphium* can best be explained by vicariance. *Microrphium* could have been common along the exposed coastal areas of the Sunda shelf during the Pleistocene, a time when the sea level dropped by about 100 meters and hence provided a dry land connection between Palawan and Borneo to the Malay Peninsula (Heaney, 1985; Ashton, 1989). The subsequent rise of sea level and the changing climatic conditions must have resulted in the extinction of *Microrphium* throughout its range, except for small populations that survived in northern Malay Peninsula and in Palawan. This striking pattern of disjunct distribution and narrow endemism is true for a number of plant groups. *Richeriella* (Euphorbiaceae) provides a good example of two disjunct species. The first species, *Richeriella gracilis* (Merrill) Pax & Hoffmann, is known from Palawan and Hainan while the second species, *R. malayana* Henderson, is known from the Malay Peninsula and northern Borneo (Airy Shaw, 1971). *Microrphium* and *Richeriella* are among the many plant groups of Sundaland distribution in which the ranges terminate in Palawan, an interesting biogeographic pattern that will be the theme of our future papers on Palawan floristics.

Palawan Conservation Needs. The narrow endemism of *Microrphium elmerianum* in Palawan suggests the need to conserve habitats that are crucial for the survival of this and many other rare species on the island. Palawan is home to numerous rare and endemic plants found nowhere else in the Philippines (Madulid, 1987). Several species of *Myrsine* have been discovered, all on ultramafics, previously thought to be endemic to Mount Kinabalu in Borneo (Pipoly, 1996). We hope that by providing scientific information on Palawan's unique biodiversity, the need for conservation is understood and the proper course of action is taken and implemented.

Paratype. PHILIPPINES. **Palawan Island:** Municipality of Puerto Princesa, Mt. Bloomfield at St. Paul's Bay, 10°12′N, 118°53′E, 5 Aug. 1988, *Soejarto & Madulid 6362* (A, F, PNH).

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The Reappearance of *Odontochilus rotundifolius* Blatter and Its Transfer to *Aenhenrya* Gopalan (Orchidaceae)

C. Sathish Kumar
Tropical Botanic Garden and Research Institute, Pacha Palode, Trivandrum-695 562, India

Finn N. Rasmussen
Botanical Laboratory, University of Copenhagen, Gothersgade 140, DK-1123 Copenhagen K, Denmark

ABSTRACT. Comparison of the types of *Odontochilus rotundifolius* Blatter and *Aenhenrya agastyamalayana* Gopalan establishes their conspecifity. An emended and amplified description of *Aenhenrya* is provided, and a new combination, *A. rotundifolia* (Blatter) Sathish & F. Rasmussen, is made.

An unusual orchid with the characters of subtribe Goodyerinae, tribe Cranichideae in subfamily Spiranthoideae (sensu Dressler, 1993) was collected by one of us (CSK) in the Western Ghats in March 1993. It was obviously not a representative of any of the known genera of Goodyerinae. Scanning of the floristic literature revealed that *Odontochilus rotundifolius*, described by Blatter (1928) from an incomplete specimen, could very well be identical with our material. Subsequently, Gopalan (1994) published *Aenhenrya agastyamalayana* gen. et sp. nov. based on a collection from Tamil Nadu, evidently belonging to the same species.

In February 1995 we received new live material collected by N. Sasidharan in the Periyar Tiger reserve in Kerala, close to the type locality of *O. rotundifolius* in the High Wavy Mountains. Detailed study of the fresh collections establishes beyond doubt that all material belongs to the same species, necessitating a new combination in *Aenhenrya*.

Aenhenrya rotundifolia (Blatter) Sathish & F. Rasmussen, comb. nov. Basionym: *Odontochilus rotundifolius* Blatter, J. Bombay Nat. Hist. Soc. 32: 521. 1928. *Anoectochilus rotundifolius* (Blatter) Balakrishnan, J. Bombay Nat. Hist. Soc. 63: 330. 1966. TYPE: India. Tamil Nadu: High Wavy Mountains, 1370–1680 m, May 1917, in dense evergreen forest, *Hallberg & Blatter 25802* (holotype, K).

Aenhenrya agastyamalayana Gopalan, J. Bombay Nat. Hist. Soc. 90: 271. 1994 [1993]. Syn. nov. TYPE: India. Tamil Nadu: Tirunelveli Kattabomman District, Poonkulam, Agastyamalai Hills, 1120 m, 24 Apr. 1991, *Gopalan 93224* (holotype, CAL; isotype, MH (157415-24)).

The original description by Blatter (1928) is rather scanty and the illustration is crude. We can confirm many observations in the drawing and description by Gopalan (1994), but the description of the column is incomplete and the pollinarium was missing from Gopalan's material. The characters associated with these structures are in fact the most interesting in the genus and are crucial for its taxonomic status. We take this opportunity to provide a more detailed illustration (Fig. 1) and a description of the column, stigma, pollinarium, and fruit based on fresh material:

Column incurved, ca. 20 mm long including the ca. 15 mm long tapering rostellar projection (sterile extension of median stigma lobe). The fertile part of the stigma is a three-lobed papillose area, with two triangular lateral lobes at the base of the column (Fig. 1C) and a third narrowly triangular lobe extending ca. 3.8 mm up on an 8–10 mm long horn-like projection, which is minutely emarginate apically. This structure was referred to as the "frontal appendage of column" by Blatter (1928) and "sword-like appendage of lip" by Gopalan (1994). It is here interpreted as an extension of the lateral stigma lobes. The side lobes of the labellum clasp this structure, forming a narrow canal (Figs. 1B, 2). The petals and the rostellum form an upper canal delimited by the lateral stigma lobe projection on the ventral side.

Anther erect, almost basal at the dorsal side of the column, connective extended distally into a narrowly elliptic structure (Fig. 1D, E), about half as long as the rostellar projection ("upper column appendage" in Gopalan, 1994).

Pollinia 2, bipartite, sectile, pear-shaped, ca. 2 × 1 mm, attached to a straplike stipe, the stipe 12 × 0.7 mm, distally ending in an ovoid viscidium, the viscidium ca. 1.5 × 0.5 mm, with a papillose dorsal surface. The viscidium leaves a distinct ± wedge-shaped scar in the rostellum on removal.

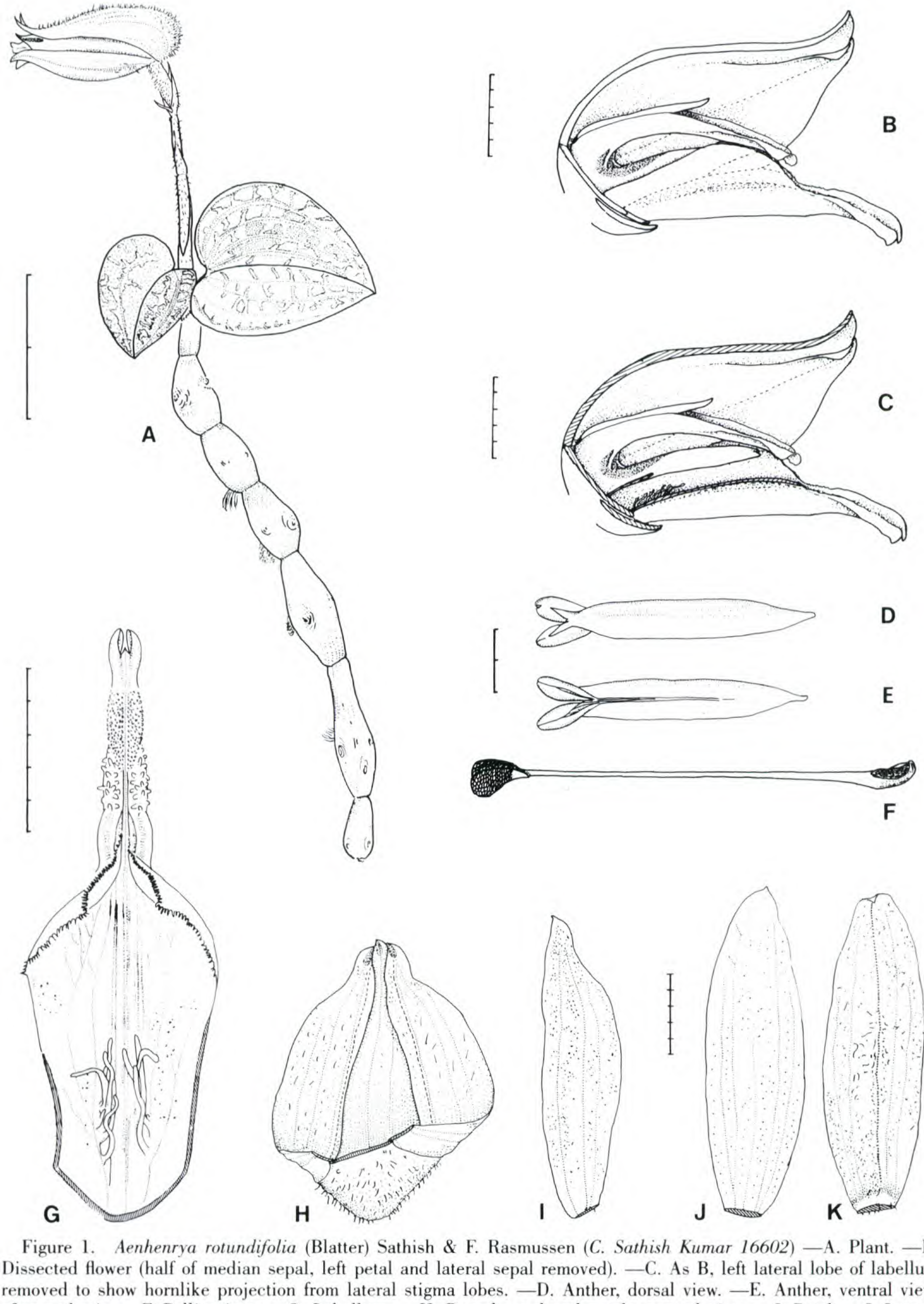

Figure 1. *Aenhenrya rotundifolia* (Blatter) Sathish & F. Rasmussen (*C. Sathish Kumar 16602*) —A. Plant. —B. Dissected flower (half of median sepal, left petal and lateral sepal removed). —C. As B, left lateral lobe of labellum removed to show hornlike projection from lateral stigma lobes. —D. Anther, dorsal view. —E. Anther, ventral view, after anthesis. —F. Pollinarium. —G. Labellum. —H. Dorsal sepal and petals, ventral view. —I. Petal. —J. Lateral sepal, dorsal view. —K. Lateral sepal, ventral view. Scale bar: A = 2 cm; B, C and G–K = 5 mm; D–F = 2 mm.

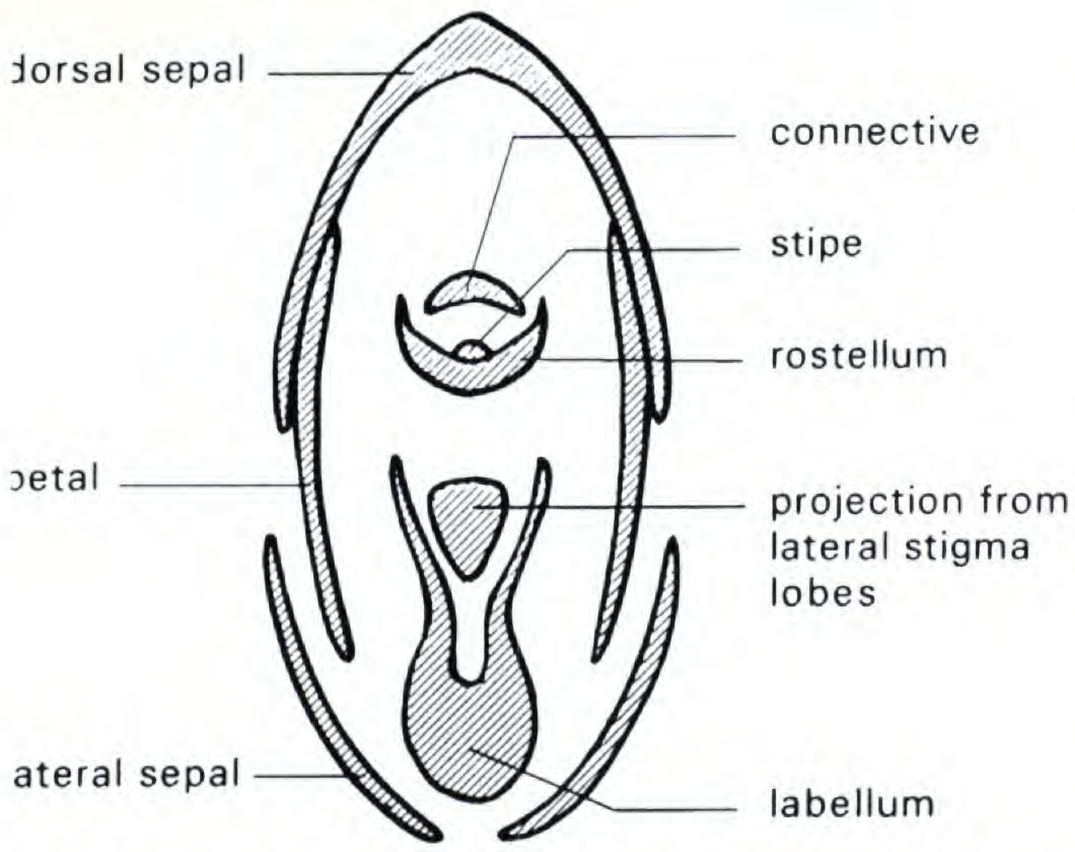

Figure 2. *Aenhenrya rotundifolia.* Diagrammatic cross section of flower.

The rostellum is not biclawed or two-armed as described by Blatter and Gopalan; this misunderstanding comes from descriptions of specimens from which the pollinarium has already been removed.

One recent collection (*S. Anil Kumar 29425*) includes mature fruits: fruit 16–23 × 5–7 mm, sessile, obovoid-obconical with 3 ridges, pubescent, grayish green. Seeds linear, 1–1.2 mm.

Sterile projections from the surroundings of the stigma, interpreted as sterile extensions of the lateral stigma lobes (Rasmussen, 1982), are known from a number of genera in Goodyerinae, but mostly from the group of genera with two receptive stigmatic areas (Diplostigmatata; Schlechter, 1926). They are a generic character of *Cheirostylis* Blume and distinctly present in most species of *Anoectochilus* Blume. Some species of *Hetaeria* Blume and *Vrydagzynea* Blume have decurrent keels from the lateral stigma lobes (Rasmussen, 1982: 49). *Aenhenrya* would technically fall into Haplostigmatata (genera with one receptive stigmatic area; Schlechter, 1926). *Dicerostylis lanceolata* Blume, a member of this group, is known to have such projections (Seidenfaden, 1978: 18); however, this species is often referred to *Hylophila* where this attribute is missing (Seidenfaden & Wood, 1992).

The sterile lateral stigma lobe projection in *Aenhenrya* is unique in being one structure, only slightly apically emarginate. It seems to emerge rather late in the ontogeny of the column. In a bud where the dorsal sepal was 8 mm long the peculiar projection was just visible as a 1-mm-long bulge below the stigma. The rostellum at that stage was 4.2 mm long, not yet extending past the anther (*C. Sathish Kumar 41*).

In the subtribe Goodyerinae well-developed stipes (pollinium stalks derived from the rostellum) are so far only recorded from species of *Zeuxine* and *Hetaeria,* which have thin stipes of the tegula type (Rasmussen, 1982). The stipe observed in *Aenhenrya* is much larger than these and is among the longest stipes known in the family. It may prove to be a strap of several cell layers, as is known from many epidendroid orchids. Ongoing investigation of the material is expected to reveal the true anatomical nature of this stipe. The papillose dorsal side of the viscidium seems to be the surface that attaches to the pollinator. A field study of the actual pollinia removal and pollination would be interesting.

The phylogenetic relations of *Aenhenrya* are not obvious. The comparatively large flowers in one- or two-flowered inflorescences, the unusual labellum, and the singular details of the column seem to be autapomorphies. It should be noted that some species of *Anoectochilus* (including *Odontochilus* Blume) actually have only one fertile stigmatic area, e.g., *A. tortus* (Seidenfaden, 1978: 51). Certain species in *Hetaeria* have sterile lateral stigmatic projections and a labellum shape that are reminiscent of *Aenhenrya,* but a more comprehensive assessment of all members of Goodyerinae is necessary to determine the phylogenetic affinities of this extraordinary orchid.

Specimens examined. INDIA. **Kerala:** Trivandrum District, SW side of Agastyamala, 1550 m, 19 Mar. 1993, *C. Sathish Kumar 16602* (C, TBGT); Idukki district, Periyar Tiger Reserve, Vellimala, 800 m, 28 May 1994, *J. Augustine 13779* (KFRI). **Tamil Nadu:** Tirunelveli Kattabomman District, Pandavanpara foothills, 1220 m, 20 Feb. 1995, *C. Sathish Kumar 41* (C, TBGT); Poonkulam, 1140 m, 19 May 1996, *S. Anil Kumar 29425* (TBGT); Ashambu hills, 1.5 mi. N of Tirukurungudi, 450–1500 m, 11 Apr. 1945, *E. Bawden s.n.* (K).

Acknowledgments. We are much indebted to G. Seidenfaden for useful comments on the material. We thank the curator at the Orchid Herbarium (K) and R. Gopalan (MH) for lending us critical material. Hanne N. Rasmussen drew Figure 1B, C, F, and Figure 2. C. Sathish Kumar is grateful to P. Pushpangadan, Director of TBGRI, for encouragement and for arranging a travel grant for work in Copenhagen. This study is part of the orchid project funded by the Kerala State Forests and Wildlife Department. The orchid project has received valuable support from the chief wildlife warden, P. K. Surendranathan Asari, and from CSK's colleagues A. Gangaprasad, A. K. Pradeep, Anil Kumar, and the tribal guide E. Appicherukkan (Kani tribe).

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Drosera graomogolensis (Droseraceae), a New Species from the *Campos Rupestres* of Minas Gerais, Brazil

Tânia Regina dos Santos Silva

Departamento de Botânica, Instituto de Biociências, Universidade de São Paulo, Caixa Postal 11641, 05422-970, São Paulo, SP, Brazil

ABSTRACT. *Drosera graomogolensis* T. Silva sp. nov. is described from the region of Grão-Mogol, Minas Gerais, Brazil. The species is included in section *Drosera* and is related to *D. villosa* A. St. Hilaire. The morphological characters that distinguish it from other species in the section are discussed, together with details of habitat.

According to Silva (1994), the genus *Drosera* in Brazil has a short stem, 0.5–1.0 cm (rarely long); spatulate leaves (rarely linear), with stipules (rarely without); two to many flowers located on cyme inflorescences; a gynoecium with 3 or 5 carpels, with 3 bipartite styles nearly to the base or 5 whole styles, and 5 or 6 lobed, two-lipped, clavate or fimbriate stigmas. The fruits are capsules with 3 or 5 valves, containing numerous seeds with reticulate or papillose testa.

In the course of floristic studies of the Brazilian "campos rupestres" (savanna-like vegetation that occurs at elevations over 600 m in the Brazilian states of Bahia, Goiás, and Minas Gerais), collections were made in the municipality of Grão-Mogol, in the northern part of the mountain range known as the "Cadeia do Espinhaço," State of Minas Gerais. A study of the species in the genus *Drosera* for the Florula of Grão-Mogol confirmed one species to be distinct from all other known species in the genus in its vegetative and floral characteristics.

Drosera graomogolensis T. Silva, sp. nov. TYPE: Brazil. Minas Gerais: Grão-Mogol, Córrego da Bonita on the way up to the Morro Jambeiro, 7 Sep. 1990, *T. R. S. Silva et al. CFCR 13506* (holotype, SPF; isotype, RB). Figure 1.

Herba 15.0–34.0 cm alta. Caules elongati, 3.0–7.0 cm longi. Folia rosulata, vinacea, matura pendentia, oblonga, 1.5–3.5 cm longa, 3.0–6.0 cm lata. Inforescentiae 1–2, vinaceae, 14.0–31.0 cm longae; flores 10–16; pedunculi 13.5–18.5 cm longi; ovaria 3-carpellaria, ad 5.5 mm longa; styli 3, ad 4.0 mm longi, profunde 2-partiti; stigmata 6, 2–3-lobata. Fructus capsularis, valvis 3; semina obovoidea, reticulata.

Herb, 15.0–34.0 cm tall. Stems elongate, 3.0–7.0 cm long. Leaves wine-red, spreading with age, forming a rosette, oblong, 1.5–3.5 cm long, 3.0–6.0 cm broad, villous on the upper ⅔ of the upper surface, the glandular tentacles radially symmetrical, glabrous on the lower ⅓, lower surface villous, the trichomes filamentous; stipules rectangular, membranaceous, 2.0–4.0 mm long, 1.5–2.0 mm broad, the laciniae 1.5–2.5 mm long. Inflorescences 1 or 2, wine-red, 14.0–31.0 cm long, bearing glandular trichomes, flowers 10–16; peduncles 13.5–18.5 cm long; bracts wine-red, linear, lower surfaces papillose with glandular trichomes, caducous; pedicels wine-red, 3.0–4.0 mm long; sepals wine-red, 4.0–6.0 mm long, united near the base, lower surfaces papillose, with glandular trichomes, laciniae oval, ca. 4.5 mm long, 1.5–2.0 mm broad, acute at the tips; petals unguiculate, 7.5–8.0 mm long; stamens ca. 4.0 mm long, anthers ca 1.5 mm long; gynoecium with 3 carpels, ca. 5.5 mm long, styles 3, ca. 4.0 mm long, bipartite nearly to the base; stigmas 6, 2–3-lobed. Fruits with 3 valves; seeds obovoid, testa reticulate.

Drosera graomogolensis is characterized by the elongate stems, the leaves that spread with age, the lobed stigma, and the obovoid seeds. The presence of spatulate leaves with petioles not distinct from the blade differentiates *D. graomogolensis* from *D. intermedia* Hayne, *D. cayennensis* Sagot ex Diels, *D. communis* A. St. Hilaire, *D. roraimae* (Klotsch ex Diels) Maguire & Laundon, *D. capillaris* Poiret, and *D. brevifolia* Pursh, all of which possess evident petioles. *Drosera graminifolia* A. St. Hilaire has linear leaves, and *D. montana* A. St. Hilaire has leaves pressed close to the ground, a short stem, and inflorescences with up to 8 flowers. *Drosera sessilifolia* A. St. Hilaire belongs to section *Thelocalyx*, which is characterized by possessing a gynoecium with 5 carpels and 5 styles with fimbriate stigmas.

Drosera graomogolensis is similar to *D. villosa* A. St. Hilaire, but the latter has short stems, a bilabiate stigma, and fusiform seeds (Fig. 2), while the leaves are pressed close to the ground. *Drosera graomogolensis* is placed in subgenus *Drosera* sect. *Drosera* (Diels, 1906).

Drosera graomogolensis is found in sizable pop-

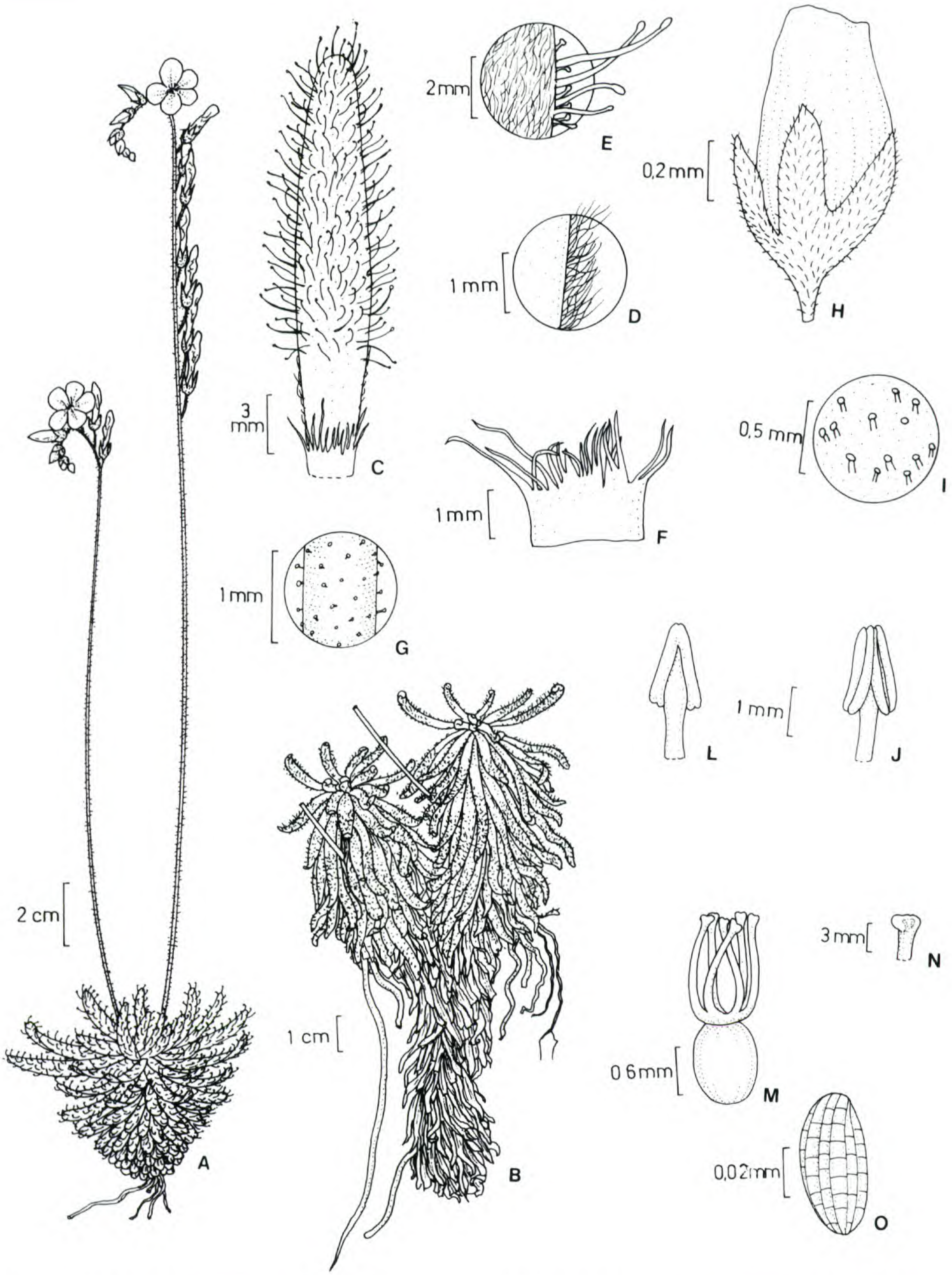

Figure 1. *Drosera graomogolensis* T. Silva. —A. Habit. —B. Habit with peduncles from previous flowering stage. —C. Leaf, upper surface. —D. Leaf, upper surface (detail). —E. Leaf, lower surface (detail). —F. Stipule. —G. Peduncle, with detail of vestiture. —H. Flower bud. —I. Sepal, with detail of vestiture. —J. Stamen, ventral surface. —L. Stamen, dorsal surface. —M. Gynoecium. —N. Stigma. —O. Seed. A, C–O based on *Cavalcanti et al. CFCR 8510* (SPF); B based on a specimen of the garden at the Universidade de São Paulo, Departamento de Botânica.

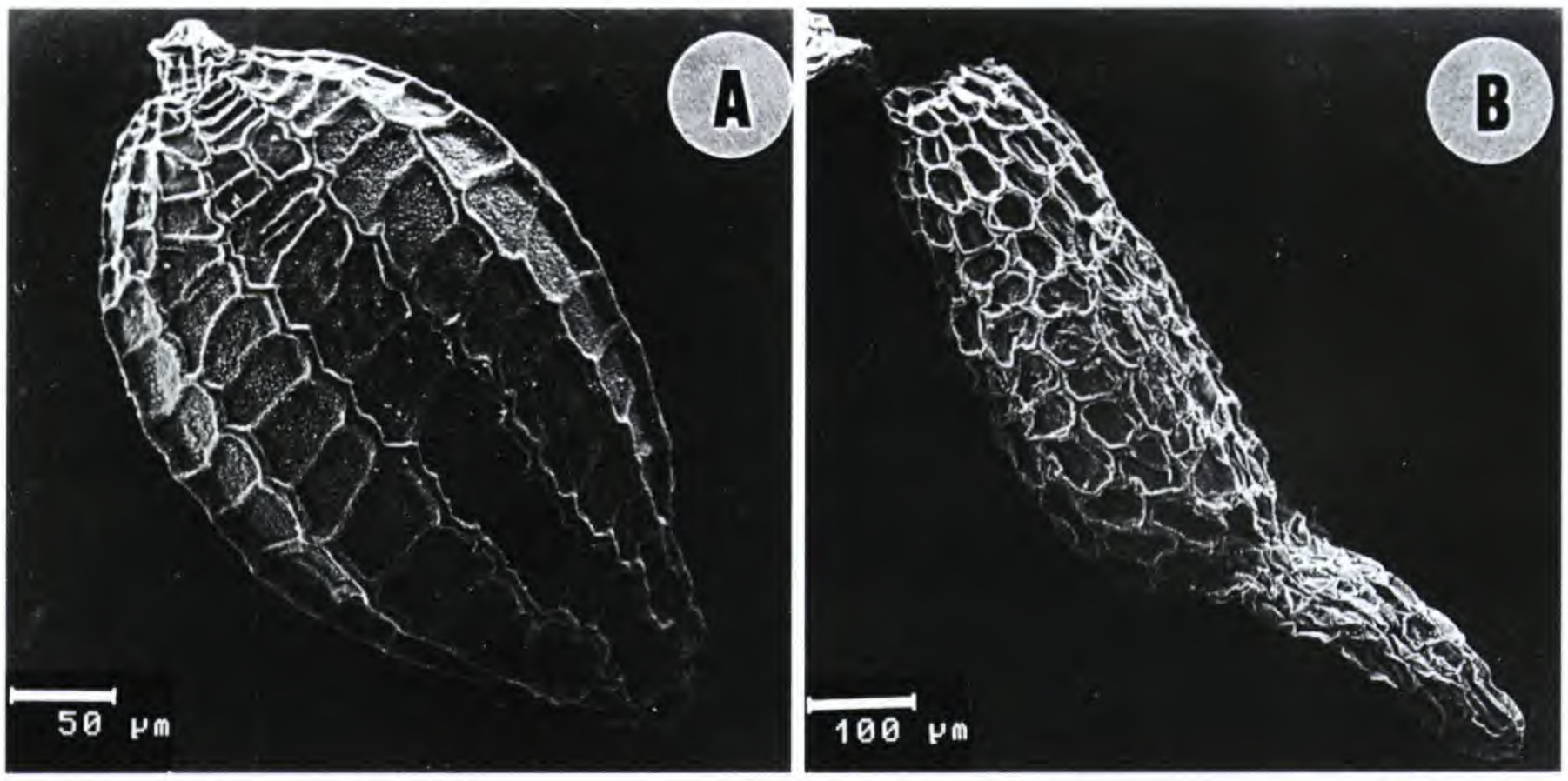

Figure 2. Micrographs of seeds (SEM). —A. *D. graomogolensis* T. Silva (*Cavalcanti et al. CFCR 8510*, SPF). —B. *D. villosa* A. St. Hilaire (*Lopes 54*, SPF).

ulations in the municipality of Grão-Mogol, State of Minas Gerais; it grows on damp or dry sandy soils, between rocks, at the flooded edges of streams, or on open ground at greater heights. It has been found in flower and fruit in the months of February, June, September, and November.

Paratypes. BRAZIL. **Minas Gerais:** Grão-Mogol, estrada de Grão-Mogol-Cristália, 15 Apr. 1981, *I. Cordeiro et al. CFCR 933* (PMA, SPF); 16 km oeste da cidade, 17 fev. 1968, *H. S. Irwin et al. 23452* (UB), ago. 1960, *Mendes Magalhães 18340* (UB); Jambeiro à 7 km de Grão-Mogol, 5 nov. 1985, *T. B. Cavalcanti et al. CFCR 8510* (SPF); Alto do Morro Jambeiro, flanco da descida para o Córrego Escurinha, 6 sep. 1990, *T. R. S. Silva et al. CFCR 13478* (SPF).

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Razisea ericae (Acanthaceae), a New Species from Ecuador and Adjacent Peru

Dieter C. Wasshausen
Department of Botany, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560, U.S.A.

ABSTRACT. Current research by the author on the Acanthaceae treatment for the *Flora of Ecuador* has resulted in the recognition of a new species from Amazonian Ecuador and Peru. *Razisea ericae* is described, illustrated, and compared with its closest relatives in Costa Rica, Panama, and Colombia.

Razisea Oersted is a New World genus of six species, most of which are endemic to Costa Rica. The genus is characterized by a shortly 2-lobed corolla with an entire upper lip and a lower lip that is barely distinct from the corolla tube. The anthers are monothecate and the pollen is spheroidal, biporate, and echinulate with the sculpturing between the spines densely granulate (Fig. 2).

Razisea ericae Mildbraed ex Wasshausen, sp. nov. TYPE: Ecuador. Napo: vicinity of Tena, Hda. Dos Rios, 650 m, 5 Apr. 1933, *Erica Heinrichs 309* (holotype, G). Figures 1, 2.

Herba vel frutex 0.5–1.5 m altus; foliorum laminae oblongo-ovatae vel ellipticae, 11–15 cm longae, 4.5–7 cm latae. Inflorescentiae racemosae, floribus oppositis, 2(–4) in fasciculis, pedicelli 1–2 mm longi; bracteae anguste triangulares, 2–3 mm longae, 1–1.5 mm latae, glabrae; calyx glaber, segmenta lanceolata, 3–4 mm longa, 0.75 mm lata; corolla rubra, 20–30 mm longa, glabra, rostrata et recurvata ante expansionem, tubo 18–26 mm longo, fauce 4–5 mm lata, labio superiore erecto, ovato, labio inferiore non profunde trilobato, lobis suborbicularibus 1 mm longis et latis; stamina 14–16 mm ultra faucem exserta; antherae 2.5 mm longae. Capsula clavata, glabra. Semina 4, orbicularia, 2 mm diam.

Herb or shrub 0.5–1.5 m. Stem quadrangular, nitid, glabrous or minutely puberulous. Leaves petiolate, petioles 1–5 cm long, glabrous or puberulous, trichomes disposed in two rows, blades oblong-ovate to elliptic, 11–15 × 4.5–7 cm, light green, subnitid, glabrous or nearly so above, even lighter green, glabrous or nearly so below, apex short-acuminate, base attenuate and decurrent on the petiole, rather thin, cystoliths prominent under a lens, margins entire or undulate; leaves subtending inflorescence much reduced, more ovate than cauline leaves. Inflorescence terminating main axis, consisting of 1–3 narrow, spikelike racemes, 10–17(25) cm long, peduncles 4–4.5 cm long, minutely puberulous; rachis puberulous. Flowers 20–25, borne laxly, solitary or in fascicles of 2(4) at opposite nodes along rachis, pedicels 1–2 mm long; bracts narrowly triangular, 2–3 × 1–1.5 mm, becoming successively smaller toward tip of inflorescence, essentially glabrous, cystoliths prominent, dense; bracteoles triangular, 1.5–2 × 0.5–0.75 mm, glabrous; calyx 3.5–4.5 mm long, deeply lobed, lobes lanceolate, 3–4 × 0.75 mm, glabrous; corolla bright red, 20–30 mm long, glabrous, rostrate and recurved before expanding, tube 18–26 mm long, about 1.5 mm wide at base, gradually expanded to 4–5 mm at throat, upper lip erect in expanded flowers, ovate, 3.5–4 × 2 mm, lower lip very shallowly 3-lobed at apex, lobes suborbicular, 1 × 1 mm; stamens exserted 14–16 mm beyond mouth of corolla tube, filaments winged, glabrous, anthers 2.5 mm long; pollen spheroidal, biporate, 64 μm diam., echinulate, sculpturing between spines of dense granulae (Fig. 2). Ovary glabrous, style filiform, equaling stamens, stigma ovoid. Capsule clavate, 14–22 × 5 × 2 mm, glabrous, green, basal stipe 6–10 mm long. Seeds flattened, irregularly orbicular, 2 mm diam., surface densely covered with minute, fringed scales.

Distribution. Amazonian Ecuador and Peru; plants occur in lowland and lower montane rainforests at elevations from 220 to 1050 m.

The monothecate anthers, the rostrate and recurved corolla buds, the strongly reduced upper lip of the corolla, and the lower lip barely distinct from the corolla tube place this new species in *Razisea*. As presently accepted, the genus includes four red-flowering species: two wide ranging, *R. spicata* Oersted found in Costa Rica, Panama, and Colombia and *R. ericae* Mildbraed ex Wasshausen found in Amazonian Ecuador and Peru; and *R. wilburii* McDade and *R. villosa* Gómez-Laurito & Hammel both found exclusively in the lowlands of Costa Rica. *Razisea ericae* can be distinguished from three closely related red-flowering species by the characters indicated in Table 1. The new taxon is

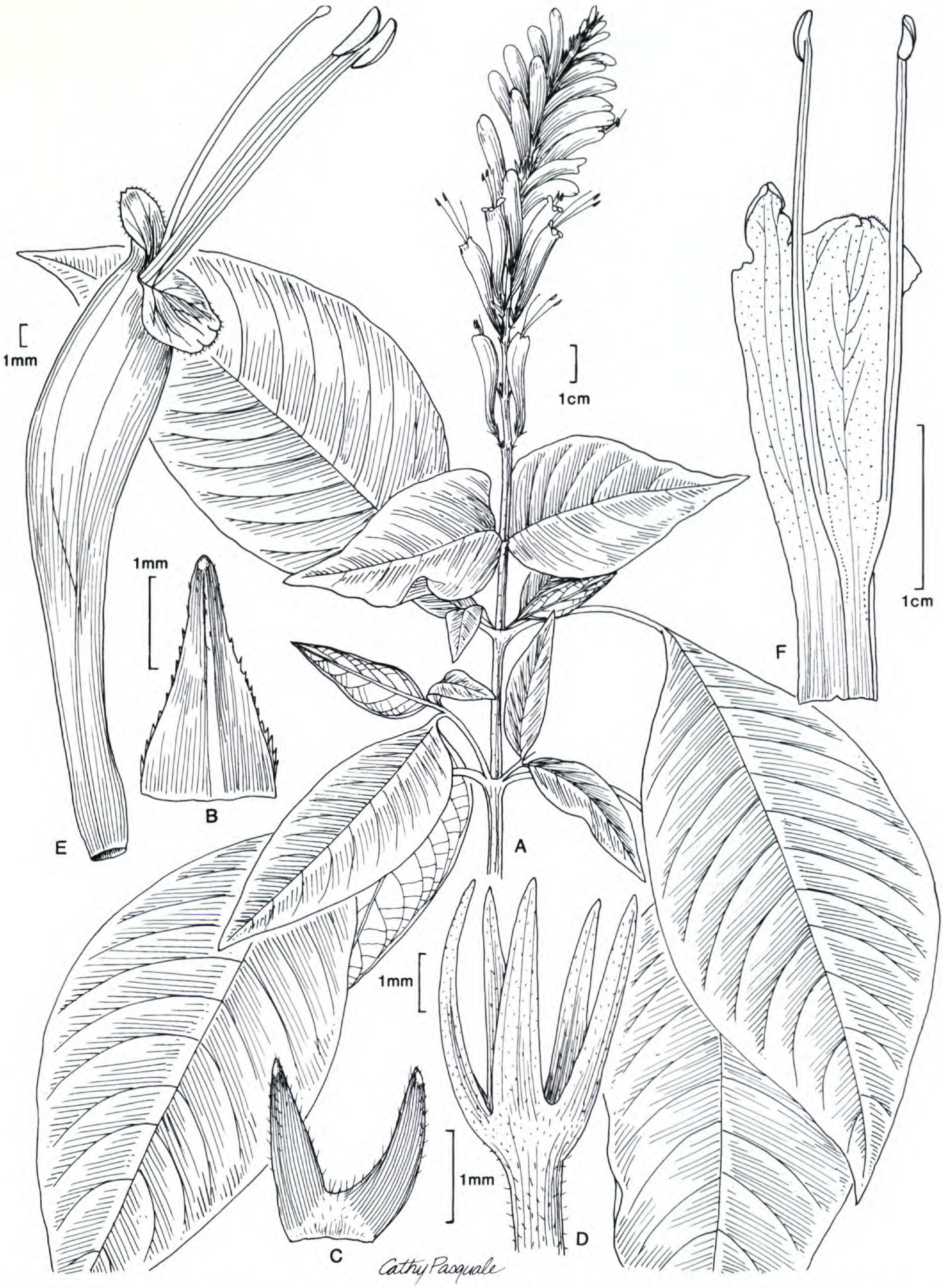

Figure 1. *Razisea ericae* Mildbraed ex Wasshausen (*Løjtnant & Molau 15769*, AAU). —A. Habit. —B. Bract. —C. Bracteoles. —D. Calyx lobes. —E. Corolla. —F. Corolla showing attachment of filaments.

easier to distinguish, in general appearance, from *R. villosa*. In *R. ericae* the stem and axis are glabrous or minutely puberulous, the calyx lobes are 3–4 mm long, and the corollas are 20–30 mm long. In contrast, *R. villosa* has conspicuously red, villous pubescence on the stem and main axis, the calyx lobes are 8 mm long (2× longer), and the corollas are 33 mm long. Two additional non-red-flowering

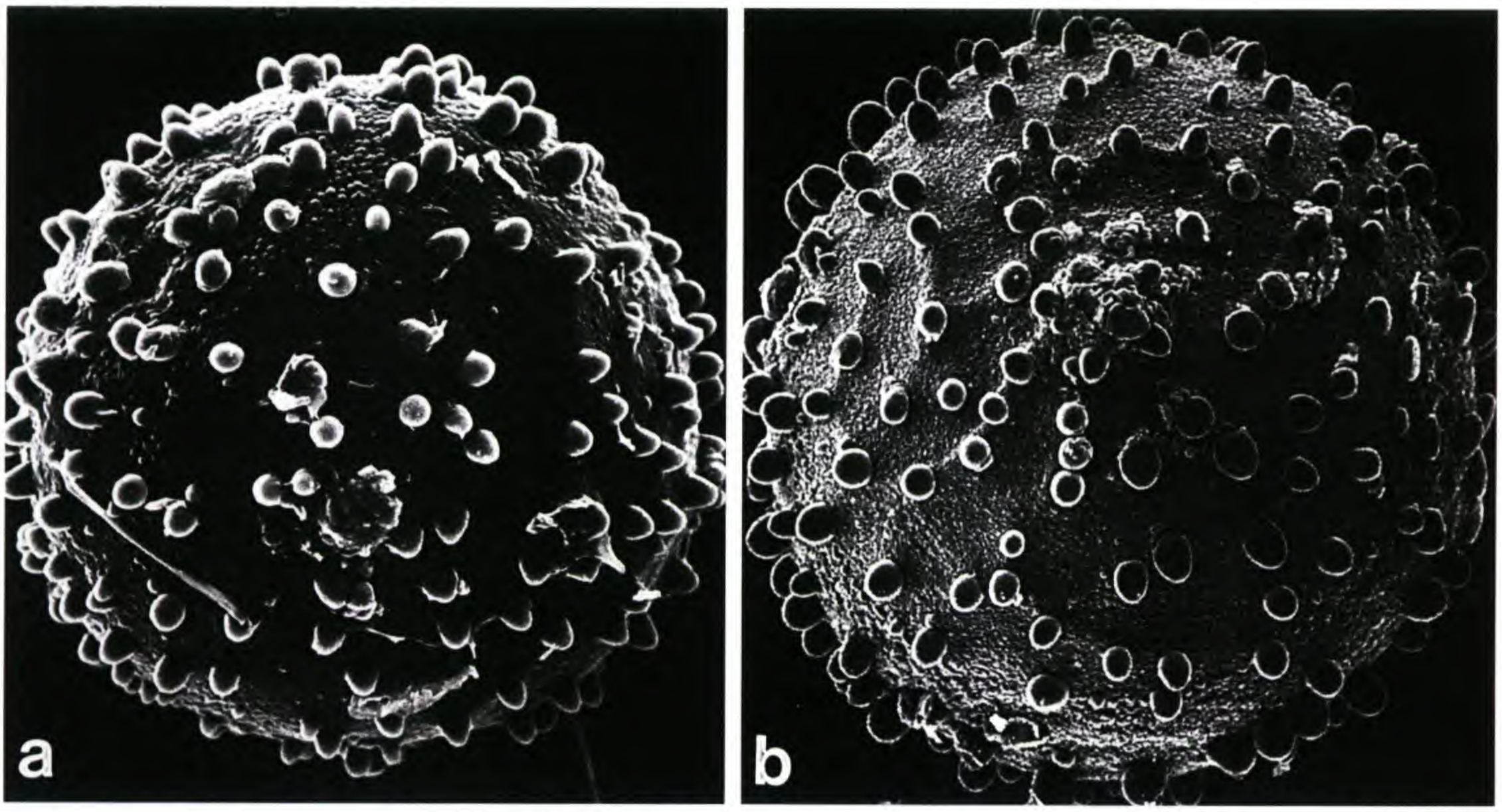

Figure 2. SEM photomicrographs of *Razisea ericae* pollen. —a. *Lugo 3280*, GB, equatorial view, ×1150. —b. *Brandbyge & Asanza 32331*, AAU, equatorial view, ×1200.

species, *R. breviflora* D. N. Gibson and *R. citrina* D. N. Gibson, endemic to different regions of Costa Rica, are also known. The orange-yellow-flowering *R. breviflora* was placed in synonymy under *Hansteinia blepharorhachis* (Lindau) Durkee (1986). I agree that *R. breviflora* should be transferred to *Stenostephanus* [the genus *Hansteinia* was recently brought into synonymy with *Stenostephanus* by Daniel (1995)], but I am not certain that it is synonymous with *H. blepharorhachis*. *Razisea citrina* is a lemon-yellow-flowering species not closely allied to the other known taxa of *Razisea*.

Paratypes. ECUADOR. **Los Ríos:** Río Palenque Science Center, 220 m, *Løjtnant & Molau 15769* (AAU, GB); km 50 on road from Santo Domingo to Quevado, 200 m, *Gentry 9637* (MO, US). **Napo:** Lago Agrio, *Lugo 3143* (GB, US); Shushufindi, road Coca–Lago Agrio, 50 km NE of Coca, *Lugo 3280* (GB, US); along Cape Ferry road, 8.8 km S of Río Aguarico on road to Coca, *Bohlin & Bohlin 328* (GB, US); San Pablo at Río Napo, 6–7 km SW of Coca, *Lugo 3041* (GB, US); Coca, San Pablo ca. 12 km

Table 1. Distinguishing characteristics of most closely related *Razisea* species.

Characters	*R. spicata* Oersted	*R. wilburii* McDade	*R. ericae* Mildbraed ex Wasshausen
Leaf length (cm)	10–20(–30)	14–20	11–15
width (cm)	3–10(–20)	6–10	4.5–7
Inflorescence	Racemose, opp. fascicles of 1–10 flowers	Racemose, opp. fascicles of 1–3 flowers	Racemose, opp. fascicles of 2(–4) flowers
Number of flowers	>50	25–125	20–25
Pedicel (mm)	1.5	2.5–5	1–2
Bract length (mm)	5	4–6	2–3
Calyx length (mm)	7–10	5–6	3.5–4.5
Corolla length (mm)	47–60	27–33	20–30
Anther length (mm)	4–5	3–3.5	2.5
Stamens, length exserted beyond upper lip (mm)	11–20	3–8	8.5–11
Stigma, length exserted beyond upper lip (mm)	5–11	1–3	10
Distribution	Costa Rica, Panama, Colombia	NE Costa Rica, Heredia	Amazonian Ecuador, Peru
Elevation (m)	0–2000	100	220–1050

NW of Coca, 250 m, *Harling et al. 19790* (GB, US); road Coca–Loreto, 12 km W of Coca, *Bohlin & Bohlin 303* (GB); 15 km downstream Río Napo from Coca, 200 m, *Brandbyge & Asanza 30133* (AAU, US); Río Payamino, ca. 10 km from mouth, ca. 350 m, *Harling & Andersson 11833* (GB, US); Limoncocha, 243 m, *Foster 3849* (AAU, QCA, US); Sinangua, "Zona de Reserva Ecológica Cayambe-Coca," 1000–1500 m, *Jaramillo & Coello 3080* (AAU, QCA); Río Yasuni, 12 km from mouth of Río Napo, 200 m, *Balslev & Alarcon 2914* (QCA); Auca Oil Field, 60 km S of Coca, 300 m, *Besse, Tan & Halton 021* (QCA, SEL); 8 km W of Lumbaque on Quito–Lago Agrio road, 500 m, *Gentry & Miller 54934* (MO, US); Canton Gonzalo Pizarro, Río Tigre, afluent of Río Dashiño, 900–1100 m, *Palacios & Neill 1586* (MO, US). **Pastaza:** Sarayaquillo, ca. 10 km E of Puerto Sarayacu, *Lugo 4014* (GB, US); Shiguacocha, 4 km E of Sarayacu, *Lugo 5572* (GB, US); trail to Copataza, 10 km S of Sarayacu, *Lugo 5552* (GB, US); Pacayacu, ca. 17 km SE of Canelos, *Lugo 4365* (GB, US); Colonia 24 de Mayo, ca. 18–20 km from Puyo, *Lugo 399* (GB, US); 2 km N of Shell-Mera, 1050 m, *Holm-Nielsen & Jeppesen 357* (AAU, US); Puyo, Pambayucua, Río Lliquino, 420 m, *Palacios 10154* (MO, QCNE, US); Kapawi (Amuntai), Río Pastaza, 235 m, *Lewis et al. 13667* (MO, US); Captaine Chiriboga, 235 m, *Lewis et al. 13755* (MO, US); 20 km S of Curaray, 300 m, *Zak & Espinoza 4996, 5166* (MO, QCNE, US). **Morona-Santiago:** Pumpuentza, 250 m, *Brandbyge & Asanza 32331, 32421* (AAU, US). PERU. **Amazonas:** Río Cenepe, *Berlin 1578* (MO, US), *Ancuash 271, 535* (MO, US); Quebrada Wampushik entsa, *Kayap 930* (MO, US); Bagua, *Vidal-Sénège s.n.* (P). **Loreto:** Provincia Maynas, Río Gueppi, *Gentry 21880* (MO, US); Iquitos, km 42 Carretera Iquitos–Nauta, *Vásquez & Jaramillo 9433* (MO, US); Alto Amazonas, Tintiyacu Andoas, *Lewis et al. 4024* (MO, US); along Río Marañón near Teniente Pinglo, just above Pongo de Manseriche, *Wurdack 2128* (US).

Acknowledgments. My special thanks to Cathy Pasquale for skillfully preparing the line drawing, and to Stephen F. Smith and the staff of the National Museum of Natural History SEM Laboratory for providing the high-quality pollen photomicrographs.

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The Authorship of *Krascheninnikovia arborescens* (Chenopodiaceae): A Correction

Sergei L. Mosyakin
N. G. Kholodny Institute of Botany, 2 Tereshchenkivska Str., Kiev, 252601 Ukraine

ABSTRACT. The authorship of *Krascheninnikovia arborescens* should be attributed to Sergei K. Czerepanov, not Sergei L. Mosyakin.

In an article recently published in *Novon* (Mosyakin, 1995), I proposed a new nomenclatural combination, *Krascheninnikovia arborescens* (Losina-Losinskaja) Mosyakin. When preparing the article, I was unaware of S. K. Czerepanov's intention to make the same combination. This combination appeared in the book *Vascular Plants of Russia and Adjacent States (the Former USSR)* at the beginning of 1995 (Czerepanov, 1995), when the first issue of Volume 5 of *Novon* was still in proofs (published on 27 March 1995). Dmitry V. Geltman of the Komarov Botanical Institute, St. Petersburg, Russia, kindly informed me that the copies of Czerepanov's book were available in January 1995. Thus, the authorship of the combination *K. arborescens* should be attributed to Sergei K. Czerepanov:

Krascheninnikovia arborescens (Losina-Losinskaja) Czerepanov, Vascular Plants of Russia and Adjacent States (the Former USSR): 186. 1995.

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Czerepanov, S. K. 1995. Vascular Plants of Russia and Adjacent States (the Former USSR). Cambridge Univ. Press, Cambridge & New York.

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Arabidopsis gamosepala and *A. tuemurnica* Belong to *Neotorularia* (Brassicaceae)

Ihsan A. Al-Shehbaz
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

Steve L. O'Kane, Jr.
Department of Biology, University of Northern Iowa, Cedar Falls, Iowa 50614-0421, U.S.A.

ABSTRACT. The new combination *Neotorularia gamosepala* is proposed. *Arabidopsis tuemurnica* is reduced to synonymy of *N. humilis*. The limits of *Arabidopsis* and *Neotorularia* are discussed.

Although *Arabidopsis thaliana* has become the plant of choice in molecular, developmental, physiological, genetic, and related studies, little is known about its immediate relatives, and the limits of *Arabidopsis* remain controversial (Al-Shehbaz, 1988; Price et al., 1994). For the past few years, the present authors have been working on the elucidation of the generic boundaries of *Arabidopsis*, and some of the species previously assigned to this genus have already been transferred to other genera (Al-Shehbaz, 1994; Al-Shehbaz & O'Kane, 1995). The present paper deals with two such controversial species.

On the basis of molecular studies (O'Kane et al., 1997), *Arabidopsis gamosepala* Hedge (endemic to Afghanistan) and *A. tuemurnica* Kuan & An (endemic to China) form with the widespread *Neotorularia torulosa* (Desfontaines) Hedge & Léonard (China west into western Russia, the Middle East, and North Africa) a well-defined clade distinctly unrelated to that including *Arabidopsis*. The evidence from morphology (see below) fully supports the molecular data to include these two species in *Neotorularia*.

Schulz (1924) separated *Arabidopsis* from *Torularia* (now *Neotorularia*) primarily on the basis of having mucilaginous instead of non-mucilaginous seeds. However, this feature is unreliable, and many genera of the Brassicaceae include species with or without seed mucilage (Vaughan & Whitehouse, 1971). The most reliable characters for the separation of these genera are the trichome and fruit types. *Neotorularia* has distinctly torulose fruits with pubescent valves, and the trichomes are primarily few to several branched. In contrast, *Arabidopsis* has non-torulose glabrous fruits, and the trichomes are simple mixed primarily with 2-forked ones. Both *Arabidopsis gamosepala* and *A. tuemurnica* have the typical features of *Neotorularia* mentioned above.

A synopsis of *Neotorularia* is being carried out by the authors, and it is estimated that the genus includes 25–30 species. Because the completion of the revision will take some time, the following nomenclatural adjustments are proposed to make them available for some of the checklists and floras in progress, especially the forthcoming treatment of the Brassicaceae for the *Flora of China*.

Neotorularia gamosepala (Hedge) Al-Shehbaz & O'Kane, comb. nov. Basionym: *Arabidopsis gamosepala* Hedge, Fl. Iran. 57: 334. 1968. TYPE: Afghanistan. Munjan: above Anjuman valley, near Anjuman, 3100 m, 14 Aug. 1965, *Podlech 12379* (holotype, M; isotype, W).

Hedge (1968) indicated that *Arabidopsis gamosepala* has no clear ally in *Arabidopsis* and that it

is anomalous in the genus for lacking the median nectar glands, a feature characteristic of *Neotorularia*. The species appears to be most closely related to *N. torulosa*, from which it is readily distinguished in being a perennial with a gamosepalous calyx. *Neotorularia torulosa* is an annual with free sepals.

Neotorularia humilis (C. A. Meyer) Hedge & Léonard, Bull. Jard. Bot. Belg. 56: 394. 1986. *Sisymbrium humile* C. A. Meyer, in Ledebour, Icon. Pl. Ross. 2: 16. 1830. TYPE: Altai, *C. A. Meyer s.n.* (holotype, LE).

Arabidopsis tuemurnica Kuan & An, Bull. Bot. Lab. North-East. Forest. Inst. 8: 44. 1980. Syn. nov. TYPE: China. Xinjiang: Wen-su Xian, Tuo-mu-er-feng, 2400 m, 24 June 1977, *Tuo-mu-er-feng Expedition 770084* (holotype, PE, listed as HP; isotype, BJM, listed as HM).

In their original description of *Arabidopsis tuemurnica*, Kuan and An (1980) compared the species with *A. thaliana* and indicated that it is an annual differing primarily in the basal leaves. However, an examination of the holotype of the former reveals that it is a short-lived perennial clearly unrelated to *A. thaliana*, especially in fruit and trichome characters. In fact, the plant is indistinguishable from the highly variable *Neotorularia humilis*, a species widespread in northern North America (Alaska and Canadian Arctic south to Colorado and east to Vermont) and northern Asia (Russia and China south to the Himalayas and west to Afghanistan, Pakistan, and Central Asia). North American authors (e.g., Abbe, 1948; Harris, 1985; Rollins, 1993) treated *N. humilis* in *Braya*. However, the molecular evidence (O'Kane et al., 1997; O'Kane, unpublished), as well as the critical morphological comparison of the species with its Asian representatives and other *Neotorularia* species, clearly support the placement of this species in *Neotorularia*. Unfortunately, all studies of the North American *Braya* completely ignored the Asian members and gave no reference to *Neotorularia* or *Torularia*. In our opinion, the North American *Braya* needs a comprehensive study, and some of its species may well prove to be *Neotorularia*, a genus up to this study not yet recognized in North America.

Acknowledgments. We are grateful to Barbara Schaal (Washington University, St. Louis) for providing the space and facilities in her lab to conduct molecular studies on various genera of the Brassicaceae. The senior author gratefully acknowledges the generous financial support of the National Science Foundation (grant DEB-9208433) and the National Geographic Society (grant 5068-93) to conduct fieldwork in Europe and Asia.

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A New Species of *Citharexylum* (Verbenaceae) from Ecuador

Gerardo A. Aymard

Herbario Universitario (PORT), Programa R.N.R., UNELLEZ, Mesa de Cavacas, Guanare, Edo. Portuguesa, Venezuela 3323. Current address: Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

Ricardo M. Rueda

Universidad Nacional Autónoma de Nicaragua-León, Facultad de Ciencias, Departamento de Biología, León, Nicaragua

ABSTRACT. A new species of *Citharexylum* from Ecuador (*C. grandiflorum*) is described, and its relationships with related species are discussed. This new species can be distinguished from all others in the genus by its significantly larger corolla.

RESUMEN. Se describe una nueva especie del género *Citharexylum* de Ecuador (*C. grandiflorum*), y se discuten sus relaciones morfológicas con las especies afines. Esta nueva especie posee las flores de mayor tamaño conocidas dentro del género *Citharexylum*.

The genus *Citharexylum* L. consists of 125 species and varieties (Jansen-Jacobs, 1988) from Bermuda, Florida, Texas, Mexico, Central America, the West Indies, Guianas, Venezuela, Colombia, Ecuador, Peru, Bolivia, Paraguay, Argentina, and Uruguay, being most diverse in the Andes and Mexico (Moldenke, 1958a).

Citharexylum belongs to the subfamily Verbenoideae, which is differentiated from the rest of the family by having a racemose inflorescence (Cantino, 1992). It is easy to separate from the other neotropical arboreous Verbenaceae by two features: a pair of glands at the top of the petiole or base of the blade, and the spike-shaped inflorescences. Additionally, like the genus *Aegiphila* the fruit is halfway enclosed by the calyx (López-Palacios, 1977).

Although a considerable amount (17 papers) of information about *Citharexylum* was published by Moldenke in the journal *Phytologia* from 1958 to 1981, we consider this genus to be not well known because the information remains dispersed and was never assembled into a reliable monograph, as has been discussed in various flora accounts (López-Palacios, 1977; Nash & Nee, 1984; Jansen-Jacobs, 1988, Aymard & Stergios, 1991; Nicolson, 1991).

Citharexylum grandiflorum Aymard & Rueda, sp. nov. TYPE: Ecuador. Napo: Jatun Sacha Biological Station, primary tropical wet forest, on low hills, 01°04′S, 77°36′W, 450 m, Jan. 1989 (fl), *D. Neill 9144* (holotype, MO; isotypes, AAU, NY, QCA, QCNE, US). Figure 1.

Haec species *C. poeppigii* Walpers affinis sed ab eo petiolo glandibus duabus 2.5–3 mm longis, praedito lamina foliari subtus parce pilosa glabrescenteve, inflorescentia 18–24 cm longa, floribus pedicellatis, tubo corollae 30–35 mm longo, differt.

Tree 7–9 m tall; branches lanate at tip and glabrescent on the lower part, flattened to tetragonal or 5-angled, hollow; nodes obliquely annulate, glabrous or lanate. Leaves ternate, blades thin-chartaceous, elliptic to elliptic-obovate, sometimes unequal in size on the same node, 13–26 × 4.5–9 cm, broadly acute and apiculate at the apex, broadly acute at the base, punctate and glabrous on upper surface, sparsely pilose to glabrescent on under surface, except along the venation, where it is puberulent; secondary veins 10–14 per side, venation impressed on the upper surface and prominent on lower surface; margins entire; petioles 2–5 cm long, sparsely adpressed pubescent, channeled above, bearing a pair of glands on the upper ¾ part of its length, 2.5–3 mm long. Inflorescence racemose, axillary, one or two per node, nutant, simple, rachis about 5 mm thick and 18–24 cm long, loosely many-flowered, sparsely pilose; bracts acuminate 2 mm long; pedicels ca. 2 mm long. Calyx 5–7 mm long, 5-dentate, the teeth very broadly rounded and apiculate, sometimes with round-shaped glands, about 5 mm wide at the mouth, externally minutely puberulent; sericeous adpressed pubescent internally; corolla white, infundibular; its tube 30–35 mm long, externally glabrous, internally pubescent at the mouth and around the stamen insertion, 5-parted; lobes ovate-lingulate, 6–7 × 3–4 mm; stamens 5, 3

Figure 1. *Citharexylum grandiflorum* Aymard & Rueda (*Neill 9144*, MO). —A. Habit. —B. Glands of the petioles 2.5–3 mm long.

shorter and 2 longer, included, inserted about 10, 12, and 14 mm from the corolla mouth; filament 1–1.5 mm long, glabrescent, style rather thick, 2–3 mm long, glabrous; stigma to 1 mm wide, slightly bilobed, pistil included; ovary obovate, 1–1.5 × 1 mm. Fruit not seen.

Distribution and habitat. *Citharexylum grandiflorum* is known from the upper Río Napo, Jatun Sacha Biological Station, at 450 m. It occurs in primary wet forest on red clay oxisols, in low hills.

Because of its ternate leaves *Citharexylum grandiflorum* is related to *C. poeppigii* Walpers from Venezuela, Colombia, Ecuador, Peru, and Bolivia (Moldenke, 1958b, 1959), but it can be distinguished from this species by the glands on the petioles 2.5–3 mm long, leaf blades sparsely pilose to glabrescent beneath, inflorescences 18–24 cm long, flowers pedunculate, and corolla tube 30–35 mm long. In contrast, *C. poeppigii* has glands of the petiole 5 mm long, leaf blades densely short-pubes-

cent beneath, inflorescences 4–16 cm long, flowers sessile or subsessile, and corolla tube 4–20 mm long.

Acknowledgments. We thank R. Liesner (MO), who first drew this new species to the attention of the senior author. We are grateful to R. Gereau (MO) and H. van der Werff (MO) for helping with the Latin description, P. M. Jørgensen (MO), J. Bradford (MO), and two anonymous reviewers for their valuable observations on the manuscript, to the Missouri Botanical Garden staff for making their facilities available for our research, and to B. Manara (VEN) for the illustration.

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Scleria amazonica, a New Species of *Scleria* Section *Scleria* (Cyperaceae) from Venezuela

Konraed Camelbeke
University of Gent, Department of Morphology, Systematics & Ecology, Laboratory of Botany, K.L. Ledeganckstraat 35, B-9000 Gent, Belgium

Mark T. Strong
Department of Botany, Smithsonian Institution, MRC/166, 10th & Constitution Ave., Washington, D.C. 20560, U.S.A.

Paul Goetghebeur
University of Gent, Department of Morphology, Systematics & Ecology, Laboratory of Botany, K.L. Ledeganckstraat 35, B-9000 Gent, Belgium

ABSTRACT. *Scleria amazonica* Camelbeke, Strong & Goetghebeur, from Amazonas, Venezuela, is described and illustrated. It differs from other South American species of *Scleria* in the presence of unisexual inflorescences. Among species of *Scleria* from the Venezuelan Guayana region it differs in the following combination of characters: the presence of a conspicuously upward pointing V-shaped ligule of dense hairs and coarsely reticulated achenes.

While preparing the treatment of *Scleria* for the *Flora of the Venezuelan Guayana*, the first author discovered a unique species of *Scleria* sect. *Scleria*. Efforts to identify this plant using published keys for *Scleria* and treatments of Cyperaceae for Venezuela and surrounding regions were unsuccessful (e.g., Adams, 1994; Core, 1936, 1951, 1965; Macbride, 1936; Pfeiffer, 1943; Schnee, 1945). After consulting with other specialists in Cyperaceae we were able to conclude that this was a species new to science.

Scleria amazonica Camelbeke, Strong & Goetghebeur, sp. nov. TYPE: Venezuela. Amazonas: Depto. Atures, ca. 8 km N of Río Orinoco, approximately opposite Caserio Patacame, 67°19′W, 04°03′N, alt. 100 m, 29 June 1979, *Otto Huber 3978* (holotype, NY pistillate). Figures 1–3.

A ceteris speciebus austro-americanis differt praesentia inflorescentiarum unisexualium. A ceteris speciebus areae Venezuelae-Guayanae differt praesentia ligulae distincte inverse V-formis hirsutaeque et achenio reticulati.

Perennial, probably dioecious, herb with thick, moniliform rhizome bearing conspicuously veined scales; roots coarse. Culm erect, trigonous, 30–120 cm long, 1.0–3.7 mm wide below inflorescence, 4.0–7.5 mm wide at widest point. Leaves many; blades green, (2–)13–42 cm long, (3–)5–12 mm wide, glabrous to slightly pubescent especially toward the apex or slightly pubescent along midrib adaxially, margins smooth to scabrous especially toward the apex, midrib smooth to slightly scabrous toward the apex, the apex abruptly narrowed to tip, probably cucullate (splitting in dried herbarium specimens), lowermost blades strongly reduced; sheaths not winged, glabrous to sparsely pubescent, the angles not scabrous; ligule conspicuously V-shaped, pointing upward, whitish to brownish, of mostly dense hairs, 0.7–1.5 mm long; contraligule triangular, unappendaged, 3.5–9.0 mm long, 3.5–7.0 mm wide at base, margin sometimes pubescent. Inflorescence strictly unisexual, paniculate with rather dense partial inflorescences, brownish, 15–46 cm long, 3–5 cm wide; primary bracts foliaceous, 1.4–25 cm long, 2–6 mm wide, glabrous to slightly pubescent on both sides, sometimes pubescent along midrib adaxially, margin and veins smooth to slightly scabrous especially toward the apex. Staminate spikelets 3.5–5.5 mm long; staminate scales with a yellowish brown to light brown midrib and brown to purple to blackish purple sides, glabrous to slightly pubescent, apex and apex margin sometimes prickly. Stamens 3, anthers ca. 1.5 mm long (excl. apical appendage), appendage 0.6–0.7 mm long, reddish to almost black, linear to narrowly triangular. Pistillate spikelets 5.0–7.1 mm long; pistillate scales with a tawny green to brown midrib and brown purplish sides, glabrous

Figure 1. *Scleria amazonica* Camelbeke, Strong & Goetghebeur. —A. Habit. —B. Achene. —C. Detail of pistillate inflorescence branch. Based on *O. Huber 3978.*

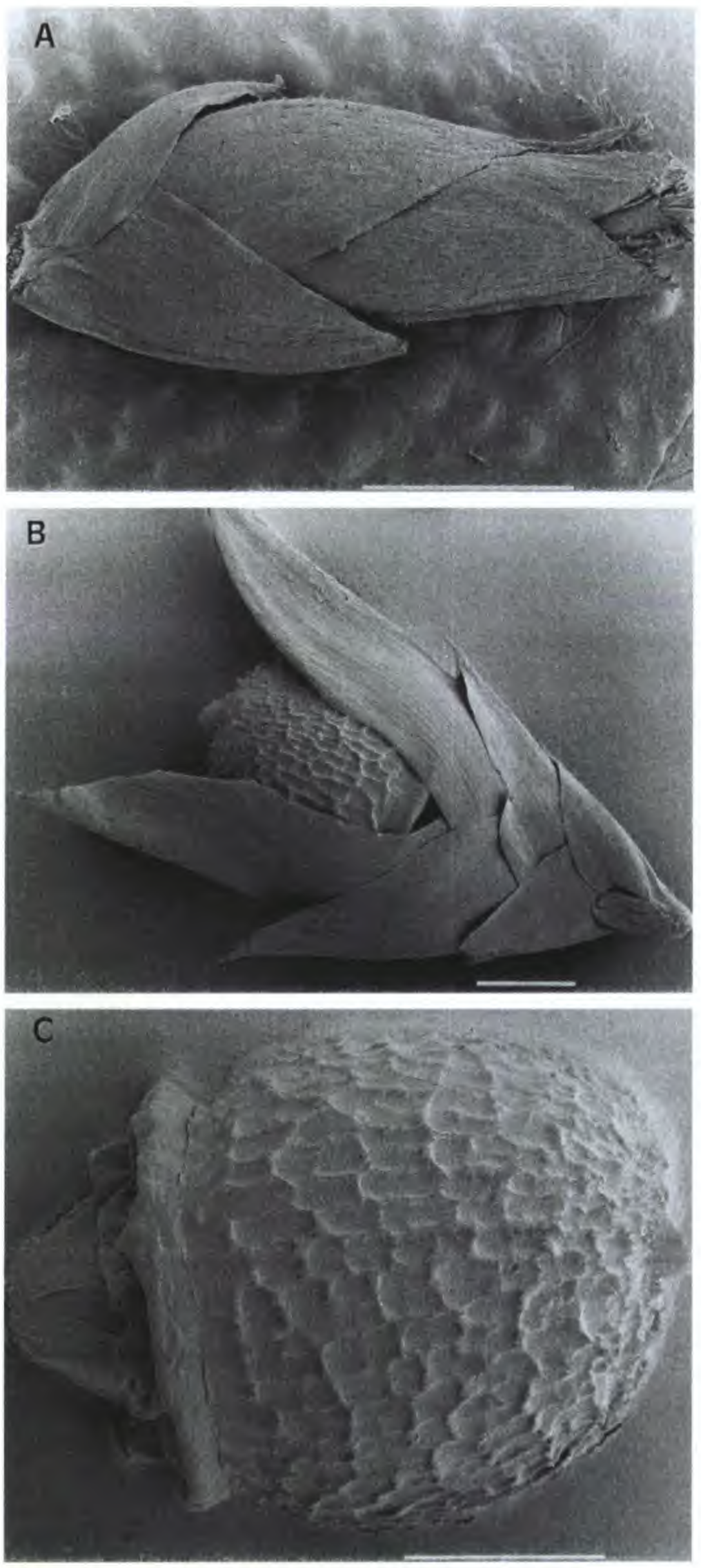

Figure 2. SEM photomicrographs of spikelets and achene of *Scleria amazonica.* —A. Staminate spikelet. —B. Pistillate spikelet. —C. Achene. Based on: A, *O. Huber & S. S. Tillett 5419*; B and C, *O. Huber 3978.* Scale bars = 1 mm.

to pubescent especially toward the apex. Style 3-fid, brown, conspicuously papillose, the style base deciduous leaving a small residue. Achene stipitate, 3.1–3.6 mm long (incl. hypogynium), 2.5–3.3 mm wide, conspicuously coarsely reticulated with prickles on walls of reticulations, white to golden blond to brownish, ovoid to very broadly ovoid to broadly ellipsoid, obtusely trigonous to almost rounded with convex sides. Hypogynium 0.6–1.5 mm long, 2.0–2.3 mm wide, yellowish to chestnut brown, surface smooth, margin glabrous, entire to inconspicuously 3-lobed, reflexed, undulate.

One specimen (*Berry P. E. et al. 5153*, MO—

Figure 3. Binocular microscope photograph of ligule of *Scleria amazonica*. Based on *G. Davidse et al. 16907*. Scale bar = 2 mm.

04619062) has three culms, of which one bears a staminate inflorescence and the two others bear pistillate inflorescences. However, the culms are not united on the same rhizome. Duplicates of all other collections were unisexual with the exception of *Huber O. 2623*, VEN—204313 = staminate, and —204314 = pistillate. Based solely on the herbarium specimens that we studied, we were unable to confirm whether this species is truly dioecious, or whether some individuals might develop unisexual inflorescences over the course of their life cycle. Field studies are necessary to help answer this question. Dioecy in *Scleria*, however, is highly unusual and only one other species in the genus is known to exhibit this characteristic, *Scleria sphacelata* F. Mueller, from Australia (Bentham, 1878: 432).

Another specimen (*Huber O. et al. 3653*, NY, VEN), from the same region as the holotype and paratypes (Venezuela. Amazonas: Depto. Atabapo, Caño Caname, 67°22′W, 03°40′N), differs from typical specimens in having a very lax inflorescence. However, as in typical *Scleria amazonica*, the inflorescence is unisexual, the achene is coarsely reticulated, and the conspicuously upward pointing V-shaped ligule of hairs is present. Because this specimen and typical *Scleria amazonica* share the aforementioned characteristics, we are tentatively recognizing them as conspecific. Discovery of additional material of this element from field studies or collections in other herbaria may prove it to be a distinct or infraspecific taxon.

We are naming this species *Scleria amazonica*, based on its occurrence in Territorio Federal Amazonas, Venezuela. The species could be present also in eastern Colombia, near the Venezuelan border. We have not yet seen any specimens from that region.

Pistillate paratypes. VENEZUELA. **Amazonas:** Depto. Atabapo, Cucurital de Caname, southern bank of the middle part of Caño Caname, 67°22′W 03°40′N, *Davidse G. et al. 16907* (MO-2); northern bank of Caño Caname, nearly opposite Cucurital de Caname, 67°22′W, 03°40′N, *Davidse G. et al. 17060* (MO); Caño Cotúa, near western base of Cerro Yapacana, 66°50′W, 03°40′N, *Huber O. 1705* (NY, VEN); Caño Caname, 67°22′W, 03°40′N, *Huber O. et al. 3695* (VEN); 2 km W of San Antonio del Orinoco, 66°47′W, 03°27′N, *Huber O. & Tillett S.S. 5438* (VEN); Santa Cruz, bank of Río Atabapo, near mouth of Río Atacaví, *Foldats E. 3708* (VEN); Depto. Atures, N of Río Orinoco, opposite Minicio, 67°32′W, 04°03′N, *Huber O. 2484* (VEN); border of Río Sipapo, near mouth of Río Guayapo, 67°36′W, 04°32′N, *Guanchez F. & Varadarajan G. S. 2563* (MO); ca. 110 km upstream Río Guayapo, 67°28′W, 04°18′N, *Foldats E. & Velazco J. 9299* (MO); Depto. Casiquiare, bank of Río Temi, near Yavita, 67°25′W, 03°00′N, *Huber O. 2623* (VEN—204314).

Staminate paratypes. VENEZUELA. **Amazonas:** Depto. Atabapo, Caño Cotúa, near western base of Cerro Yapacana, 66°50′W, 03°40′N, *Huber O. 1706* (VEN); 2 km W of San Antonio del Orinoco, 66°47′W, 03°27′N, *Huber O. & Tillett S. S. 5419* (VEN); mouth of Mesague, 67°06′W, 03°04′N, *Velazco J. 958* (MO); Santa Cruz, bank of Río Atabapo, near mouth of Río Atacaví, *Foldats E. 3805* (VEN); Depto. Atures, ca. 2 km upstream of San Juan de Ucata, on the Caño Ucata, 67°44′12″W, 04°20′25″N, *Berry P. E. et al. 5153* (MO—04619069); ca. 110 km upstream Río Guayapo, 67°28′W, 04°18′N, *Foldats E. & Velazco J. 9285* (MO); N of San Juan de Ucata, 67°49′W, 04°20′N, *Romero G. A. et al. 2074, 2076* (MO); Depto. Casiquiare, bank of Río Temi, near Yavita, 67°25′W, 03°00′N, *Huber O. 2623* (VEN—204313); ca. 5 km W of middle of Río Temi, 67°29′W, 02°57′N, *Huber O. 3416* (VEN); near Chapezon, between Boca de Casiquiare and Solano, 67°03′W, 01°58′N, *Liesner R. & Carnevali G. 22920* (MO).

Mixed paratype. VENEZUELA. **Amazonas:** Depto. Atures, ca. 2 km upstream of San Juan de Ucata, on the Caño Ucata, 67°44′12″W, 04°20′25″N, *Berry P. E. et al. 5153* (MO—04619062).

Acknowledgments. We express our gratitude to

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A New Species of *Oreopanax* (Araliaceae) from Costa Rica

M. J. & J. F. M. Cannon
Department of Botany, The Natural History Museum, Cromwell Road, London SW7 5BD, United Kingdom

ABSTRACT. *Oreopanax anomalus*, with narrow leaves unusually closely packed around the inflorescence and along the branchlets, is described in preparation for treatments in *Flora Mesoamericana* and *A Manual to the Plants of Costa Rica.*

Oreopanax anomalus M. & J. Cannon, sp. nov. TYPE: Costa Rica. Reserva Biologica Monteverde, Arancibia de Miramar, Leonel Hernandez, 1600 m, 5.10.1989, *Bello 1341* (holotype, BM).

A speciebus aliis foliolis linearis vel angustissimis confertis differt. Arbor parva, foliis simplicibus, confertis, lamina 8–13 × 1–2 cm, lineata vel angustissime elliptica, petiolo ad 5 cm. Inflorescentia hermaphrodita subumbellata, ramis ad 3 cm longis, bracteis floralibus 1–2 mm longis, suborbiculatis. Fructus 2–3(–4) per capitulum 3–4 × 3–4 mm, loculis lignis, stylis 6–7, in fructo non immersis. Semina albumine laevigato.

Tree of 3 m, branchlets stout, nigrescent, densely covered with closely packed leaves, indumentum absent in mature specimen. Lamina 8–13 × 1–2 cm, linear to very narrowly elliptical, coriaceous, without pellucid dots. Lateral veins scarcely visible, midrib pale colored, markedly raised beneath, somewhat raised above, margin entire inrolled and pale colored, apex and base acute, petioles 1.5–5 cm, bases not expanded. Male inflorescence not seen. Hermaphrodite fruiting inflorescence compact subumbellate, exceeded by current terminal growth, branches up to 3 cm, subtending bracts 1–2 mm cuspidate, peduncles 1–3 mm, subtending bracts suborbicular, floral bracts 1–2 mm, suborbicular; fruits 2–3(–4) per head, locules 3–4 × 3–4 mm, subglobose, walls becoming markedly woody, carpels and styles 6–7, 0.5 mm, the bases scarcely sunken within the fruit, free or swollen and connate at the base, spreading and recurved above, endosperm smooth.

The specific epithet draws attention to the very unusual appearance of this plant, known only so far from the type specimen, with its very narrow leaves unusually closely packed around the inflorescence and along the branchlets. While the generic affinity of this species is clear, its relationship to other species known to us is very obscure and until further material is available we are unable to suggest any clear affinities.

This specimen of a very unusual *Oreopanax* was received after the main study of the Araliaceae for *Flora Mesoamericana* had been completed. Its publication is required for *FMA* and *A Manual to the Plants of Costa Rica.* Two duplicates are recorded as having been collected, but we have been unable to trace these. The original field label refers to "buds," but it seems likely that the collector misinterpreted the fruit in this way.

NOVON 7: 102. 1997.

A New *Sonerila* (Melastomataceae) from Central Kalimantan, Borneo

Nicoletta Cellinese

University of Reading, Botany Department, School of Plant Sciences, Reading RG6 2AS, United Kingdom. Current address: University of Florida Herbarium (FLAS), 209 Rolfs Hall, P.O. Box 110530, Gainesville, Florida 32611-0530, U.S.A.

ABSTRACT. *Sonerila* is a genus of ca. 100–175 species distributed from Sri Lanka and southern India to the Indo-Pacific region. It is the only trimerous genus (except for the monotypic *Stussenia* C. Hansen and *Lithobium* Bongard) in the Melastomataceae, with the flowers having one or rarely two whorls of stamens. *Sonerila nagyana*, described and illustrated here, has one staminal whorl and is unusual in its rosette habit with succulent and lanceolate leaves. It was discovered in heath forest in the Upper Barito Ulu region in Central Kalimantan, Borneo.

Indonesian Borneo comprises the provinces of Kalimantan Barat (West), Kalimantan Tengah (Central), Kalimantan Timur (East), and Kalimantan Selatan (South). During a recent expedition I visited the area near the junction of the Rekut and Busang Rivers (Upper Barito Ulu, Central Kalimantan), tributaries of the Barito River. This is one of the largest rivers in Kalimantan, flowing from the hills of the province of Kalimantan Tengah to the South Java Sea, a distance of approximately 800 km (380 km direct). The landscape in the Upper Barito Ulu area consists of undulating terrain cut by numerous streams that ranges in elevation from ca. 150 to 500 m. The predominant vegetation type is mixed lowland dipterocarp forest with a few patches of heath forest (kerangas). The new *Sonerila* species was found growing in a patch of such forest, east of the Rekut basecamp (113°59′20″E, 0°03′40″S; Fig. 1), at an elevation of ca. 500 m. It grew epiphytically on a low tree trunk in mossy substrate that in places was 40 cm thick; the soil pH was ca. 2.8.

Statistics indicate that while the island of Borneo as a whole is among the better collected areas of the humid tropics, collecting in Indonesian Borneo (Kalimantan) is very limited, and Kalimantan is among the least collected regions of the world (Ashton, 1989). The flora of the Upper Barito Ulu region is extremely diverse and botanically understudied, especially as regards herbaceous plants. During my visit in the Rekut area, among other Melastomataceae I was able to collect five species of Sonerileae, a tribe of predominantly herbaceous plants of rainforests. Three species belonged to the genus *Phyllagathis*, which I am currently revising, and two to *Sonerila*. The latter are *S. beccariana* Cogniaux, a new record for the area, and *S. nagyana*, the species described here.

Sonerila beccariana is fairly widespread and belongs to a group of *Sonerila* species that have obconical capsules which dehisce mainly apically. The fruit placenta in these species is stalked, and the column does not bend out of the capsule to facilitate seed dispersal (Cellinese, 1997). *Sonerila nagyana* is unusual in *Sonerila* in having a rosette of succulent and lanceolate leaves; all other species I have seen have membranaceous leaves, and rosette-species have broadly ovate to rounded leaves. *Sonerila nagyana* belongs to a second group of *Sonerila* species with triangular capsules and sessile or subsessile placentae. At maturity, the capsules dehisce along a longitudinal suture, and the placenta column bends out of the capsule and exposes the placentae with the attached seeds for rainwater

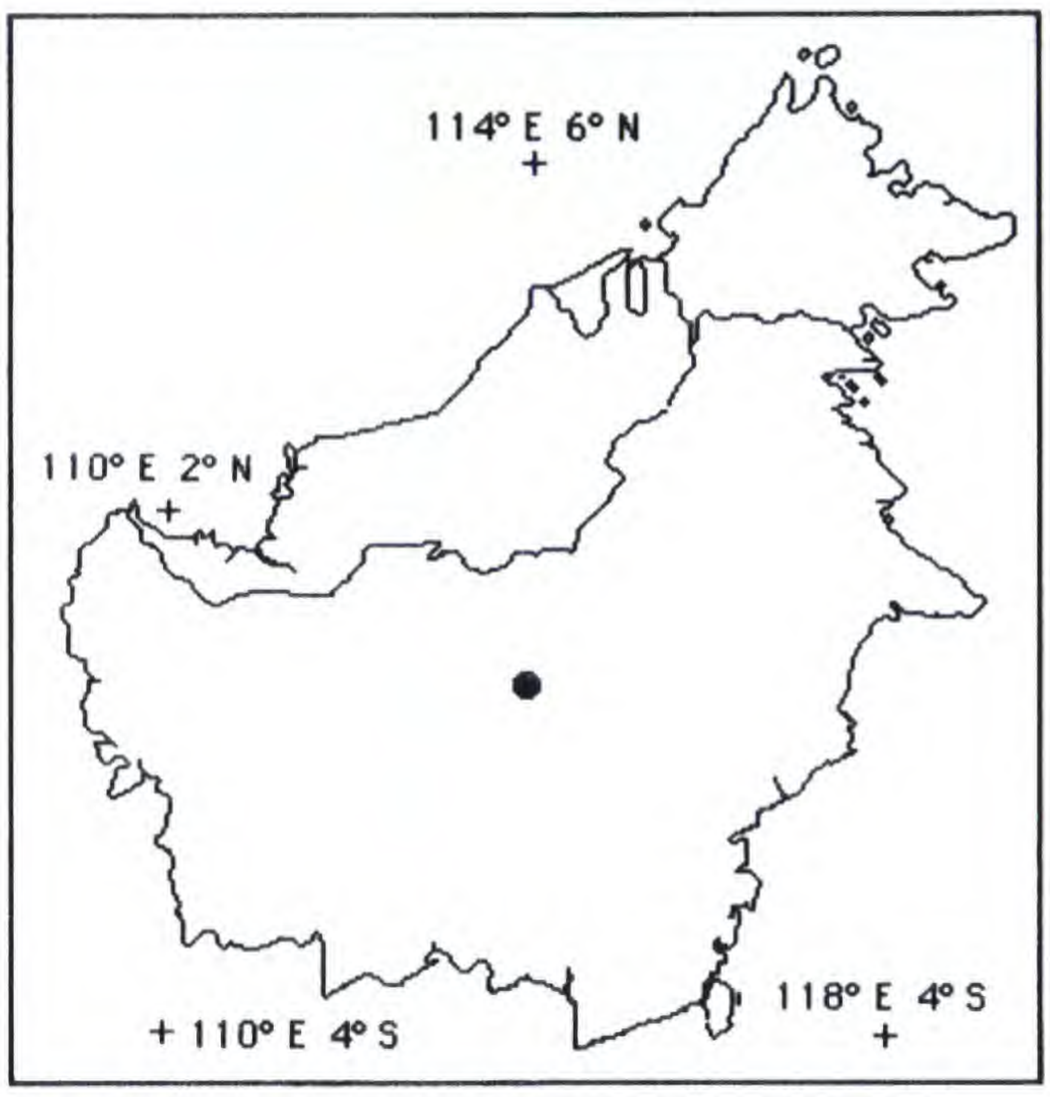

Figure 1. Distribution of *Sonerila nagyana*.

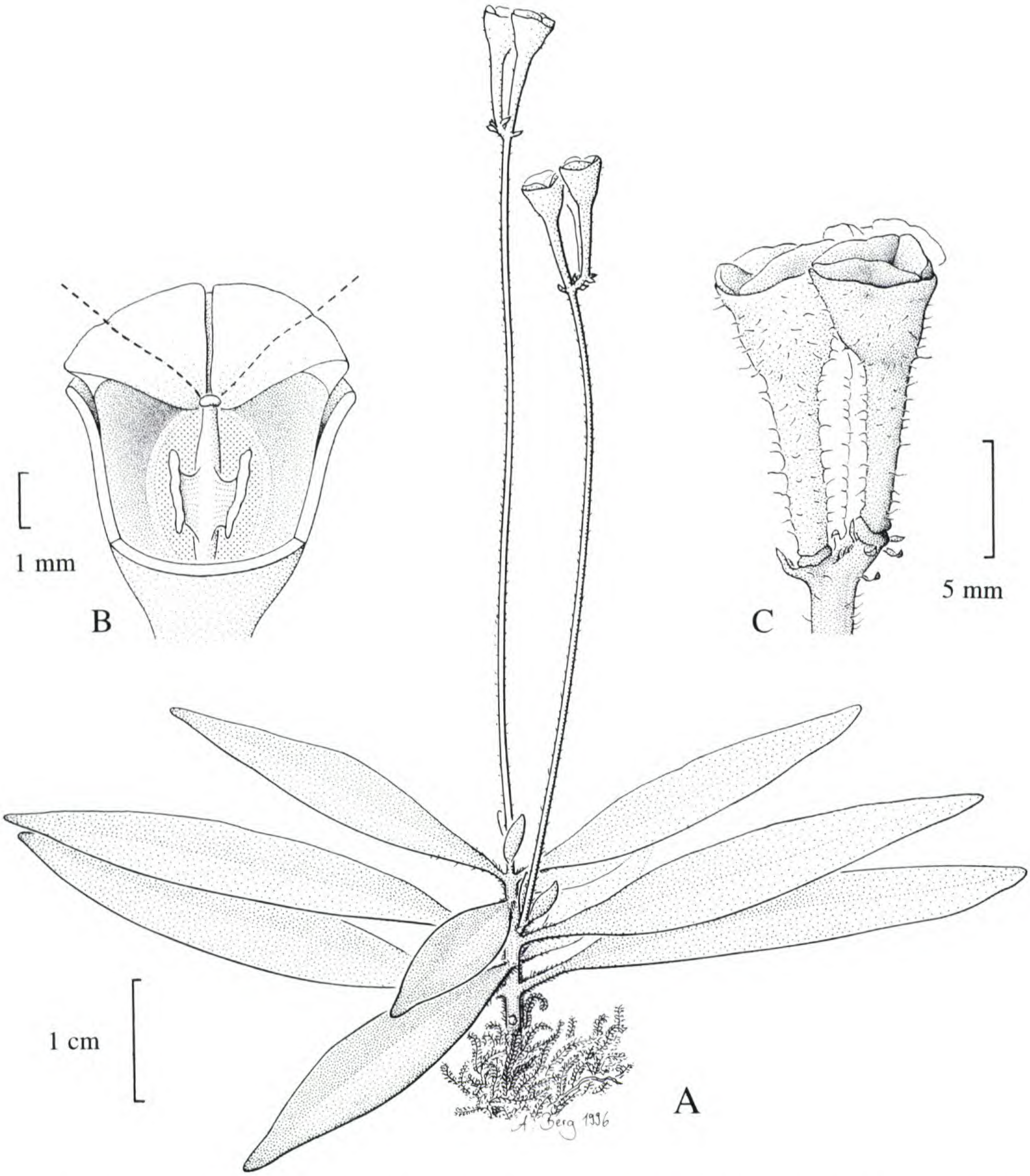

Figure 2. *Sonerila nagyana* Cellinese. —A. Habit. —B. Longitudinal section of a capsule. —C. Capsules. (Drawn from the holotype, *Cellinese 66*, BO.)

dispersal. This type of seed dispersal has also been observed in other Bornean species of *Sonerila* (Cellinese, 1997).

Sonerila nagyana Cellinese, sp. nov. TYPE: Borneo. Kalimantan Tengah: Upper Barito Ulu, E of Rekut basecamp, 28 Aug. 1995, *Cellinese 66* (holotype, BO; isotypes, FLAS, K, L). Figure 2.

A ceteris speciebus Sonerilae habitu rosulato, succulento et folia lanceolata recedit.

Rosette herb up to ca. 15 cm tall including the peduncles, the stem terete, tinged with red. Leaves opposite, equal, lanceolate, 1.5–6 × 0.3–1.6 cm, the base acute or attenuate, the apex acute, the margin entire, the lamina 1- or occasionally 3-nerved, glabrous, succulent, both surfaces tinged with dark red, in young seedlings sometimes tinged

only on the lower surface. The petiole 0.2–1 cm long, red, sparsely covered with short bristles. Inflorescence a terminal or axillary scorpioid cyme, 1–4-flowered, the peduncle 3.3–5.5 cm long, red, with scattered short hairs. Flower 3-merous, only known from buds, the pedicel about 5 mm long, with scattered short hairs, subtended by 2 small lanceolate bracts, ca. 2 mm long, the bracts apparently persistent in fruit. Hypanthium campanulate, 4 mm long, sparsely covered with short hairs, the calyx lobes triangular, less than 1 mm long, acute. Petals lanceolate, pinkish. Stamens 3, the filament red, the anthers ovate, opening apically by a single pore, pale yellow. Ovary 3-celled, crowned by 3 scales surrounding the base of the style, ovules numerous. Fruit a triangular obpyramidal capsule, 9 × 3 mm including the tapering stalk, sparsely covered with bristly hairs, fruit placenta ca. 1 × 0.3 mm, subsessile. Seeds minute, numerous.

Flowering. August–September.

Elevation. Ca. 500 m.

Known only from the type locality, *Sonerila nagyana* occurs in small and apparently rather localized populations. The heath forest in the area was dominated by *Gymnostoma sumatranum* (Junghuhn ex Vriese) L. A. S. Johnson, *Syzygium*, and *Dacrydium* spp.

The epithet refers to Laszlo Nagy, who kindly showed me the beautiful locality where *S. nagyana* was discovered.

Acknowledgments. This research was supported by a grant from the EU Human Capital and Mobility Programme "Botanical diversity in the Indo-Pacific Region." I am grateful to the Lembaga Ilmu Pengetahuan Indonesia (Indonesian Institute of Science, LIPI) for allowing me to visit Central Kalimantan; to Laszlo Nagy for his help throughout the time I spent at the Rekut Camp (Project Barito Ulu) where this study was carried out; to John H. Beaman, Roger Lundin, and an anonymous reviewer for helpful comments on the manuscript; and to Anke Berg who kindly drew the plate. A special thanks to Susanne S. Renner for her invaluable help in supervising my work.

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New Species and New Combinations in *Sonerila* and *Phyllagathis* (Melastomataceae) from Thailand

Nicoletta Cellinese

Botany Department, School of Plant Sciences, University of Reading, Reading RG6 2AS, United Kingdom. Current Address: University of Florida Herbarium (FLAS), 209 Rolfs Hall, Gainesville, Florida 32611-0530, U.S.A.

Susanne S. Renner

Department of Biology, University of Missouri-St. Louis, 8001 Natural Bridge Rd., St. Louis, Missouri 63121-4499, U.S.A.

ABSTRACT. While revising the Melastomataceae for the *Flora of Thailand*, we discovered two new species of *Sonerila*, as well as the need for transferring two species of *Tylanthera* endemic to Thailand into *Phyllagathis*. *Sonerila urceolata* and *S. loeiensis* are endemic to the southeast and the northeast of Thailand, respectively. The first is allied to the widespread *S. erecta* Jack, from which it differs mainly in the strongly urceolate capsule and the sessile fruit placenta; the second is distinguished from other acaulescent species of *Sonerila* by its extremely long-petiolate large leaves and long-pedunculate inflorescence. The new combinations, *Phyllagathis tuberosa* (Hansen) Cellinese & Renner and *P. siamensis* Cellinese & Renner nom. nov., are made because both taxa lie inside the morphologic and phylogenetic bounds of *Phyllagathis*.

During work on the Melastomataceae for the *Flora of Thailand* (Renner et al., in press), we came across *Tylanthera* Hansen, a genus based on two collections from Thailand of plants similar in habit, but representing two species (Hansen, 1990). Both species have a tuber or rhizome with a stunted growth and one or a few growing points, producing one to few long-petiolate membranaceous leaves and a single inflorescence (Figs. 1, 2). Both also have four stamens and no staminodes. According to Hansen the 4-merous haplostemonous flowers of the two species precluded their placement in *Phyllagathis*, a closely related genus that normally has 4-merous but diplostemonous flowers. Both species resemble *Phyllagathis* spp. in capsule morphology (the capsules have relatively thin tops), inflorescence structure (scorpioid cymes or umbels), and stamen morphology (the connectives are dorsally thickened). As pointed out by Hansen, an androecium of only four stamens is uncommon in the Sonerileae but occurs in a few species of *Phyllagathis* sensu lato (including *Aschistanthera* Hansen, *Brittenia* Cogniaux ex Boerlage, *Cyanandrium* Stapf, *Cyphotheca* Diels, *Enaulophyton* Steenis, *Kerriothyrsus* Hansen, *Scorpiothyrsus* Li, and *Tigridiopalma* Chen), such as *P. tetrandra* Diels from southern China. In general, there is a pronounced tendency in the Sonerileae, a large pantropical tribe, to reductions in the androecium, with the inner set of stamens becoming staminodial (Renner, 1993). Also, in a monophyletic *Phyllagathis* (Cellinese et al., monograph in prep.) it is clear that haplostemony has arisen several times. Another feature shared by species of *Phyllagathis* and the two species of *Tylanthera* is the dorsally thickened connective (Figs. 1, 2). A dorsally and/or ventrally thickened or appendaged connective also occurs in some species of *Phyllagathis*, such as the Bornean *P. pachystachya* Hansen.

A third character adduced by Hansen to justify placing at least one of the two species in a separate genus was the ellipsoid seed shape of *T. tuberosa* (see Hansen (1990) for SEM photographs of the seeds of *T. tuberosa* and *T. cordata*). He suggested that such seeds were unknown in *Phyllagathis*. However, a comparison of the seeds of *T. cordata* and *T. tuberosa* (Hansen, 1990: fig. 3) shows that they are very similar in testa surface and shape, except for the somewhat less well developed beak in *T. tuberosa*. Note that most Sonerileae investigated have beaked seeds and that seed shape is therefore of little help in the generic placement of species in this tribe. (Seed SEMs resulting from Hansen's work have been incorporated into the Copenhagen herbarium and are sent on loan together with the respective material.) Because *Tylanthera* as circumscribed by Hansen

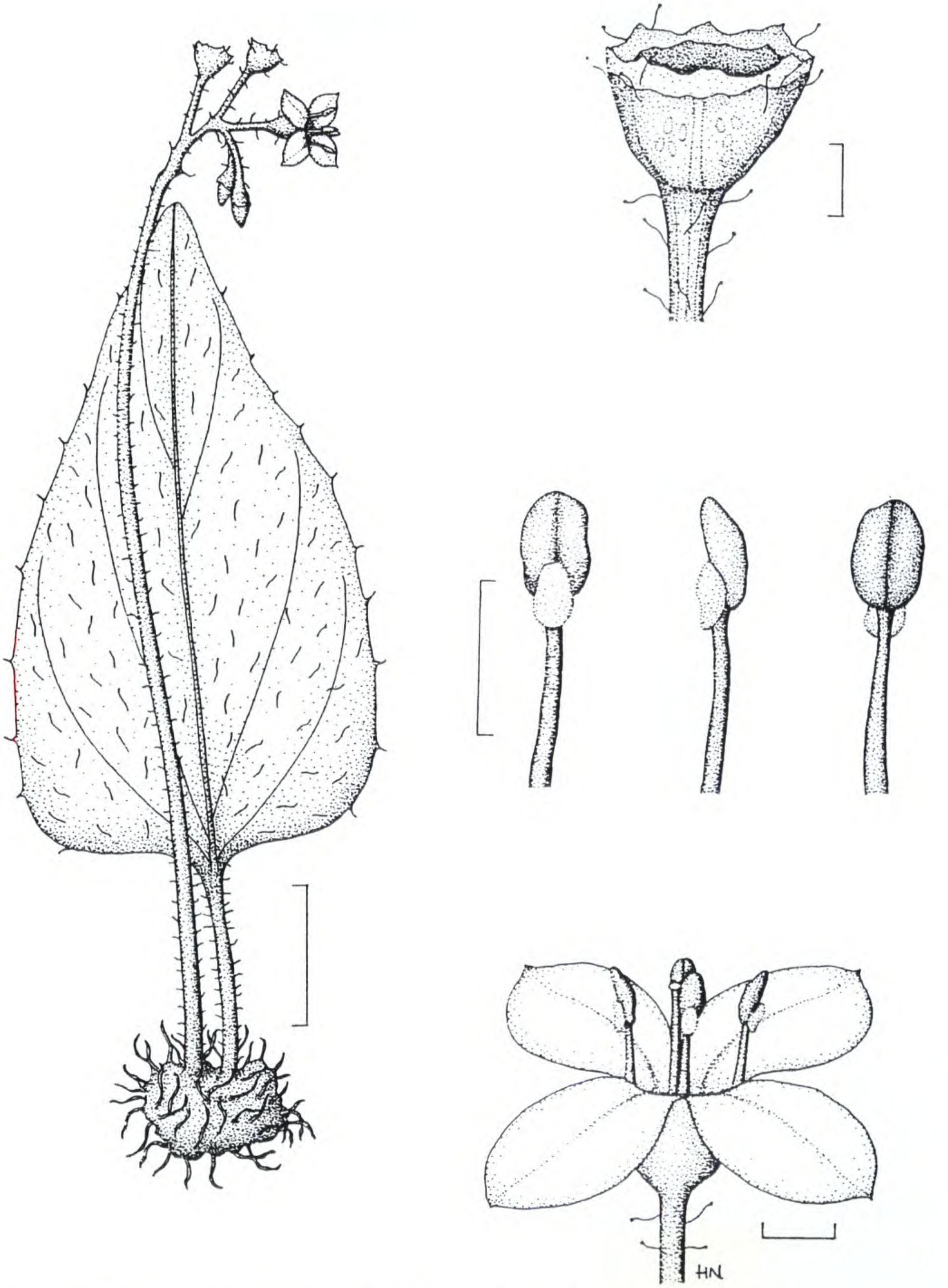

Figure 1. *Phyllagathis tuberosa* (Hansen) Cellinese & S. S. Renner. Habit; scale bar = 1 cm. Flower; scale bar = 1 mm. Dorsal, lateral, and ventral views of stamen; scale bar = 2 mm. Capsule; scale bar = 1 mm.

thus lacks diagnostic features as well as synapomorphies that could be construed as supporting its monophyly, we see no reason to continue excluding these two species from *Phyllagathis*, with which they share so many traits.

The two species are clearly distinct. *Tylanthera tuberosa* (Fig. 1) has a scorpioid cyme, the connective is dorsobasally enlarged into a peltate appendage, and the ovary lacks apical scales; the inflorescence of *T. cordata* (= *Phyllagathis sia-*

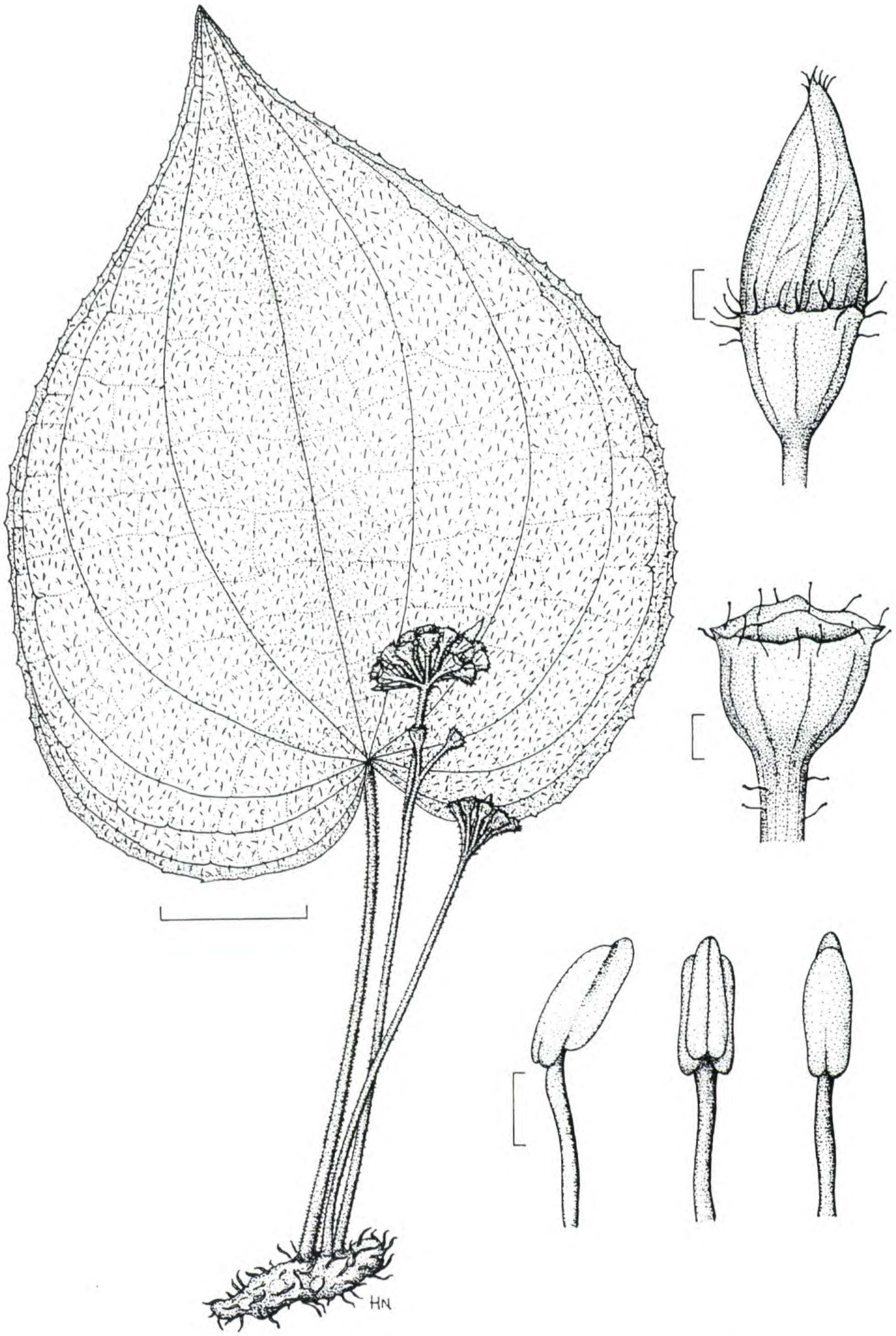

Figure 2. *Phyllagathis siamensis* Cellinese & S. S. Renner. Habit; scale bar = 1 cm. Lateral, ventral, and dorsal views of stamen, capsule, and flower bud; scale bars = 1 mm.

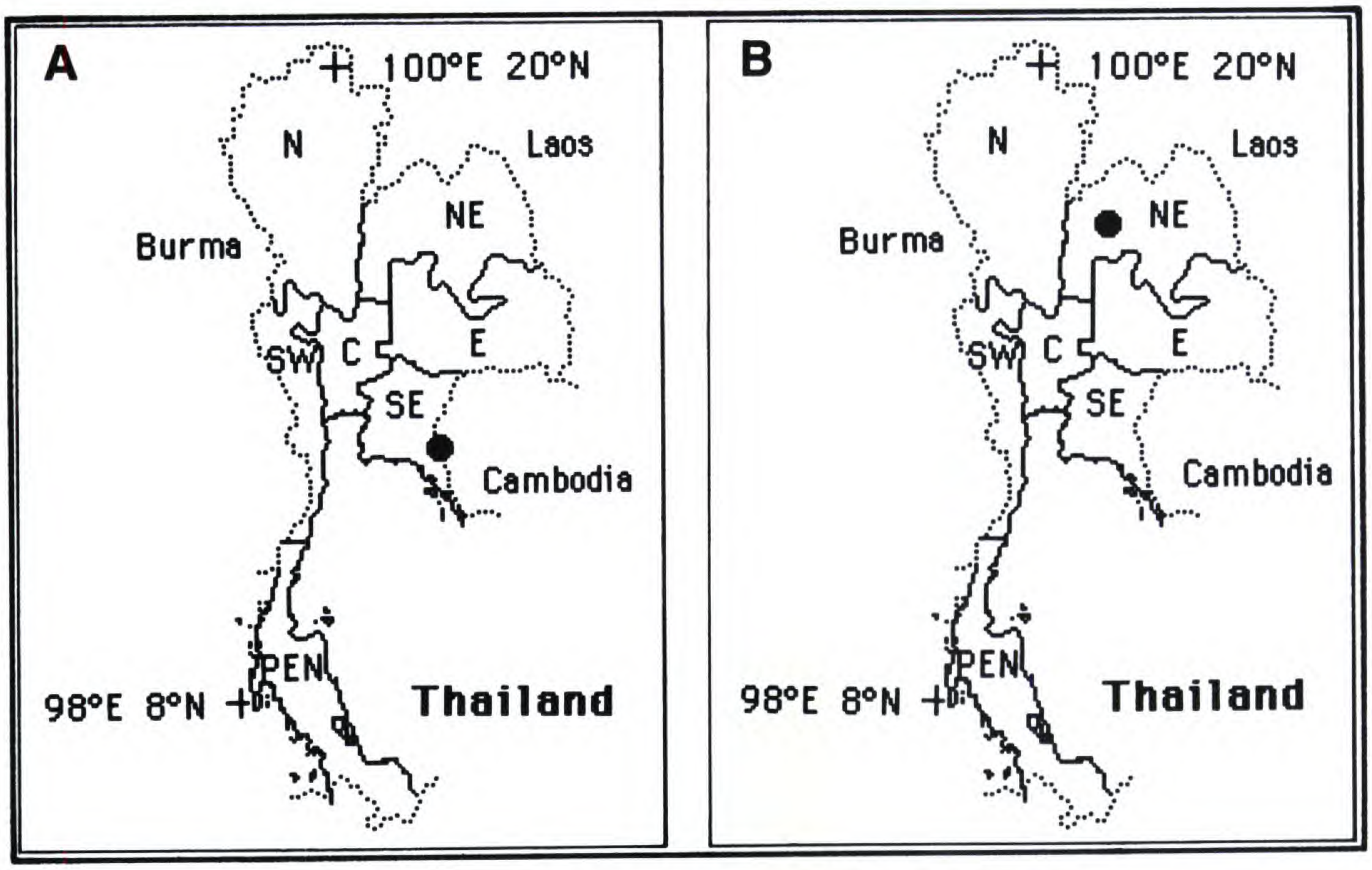

Figure 3. —A. Distribution of *Sonerila urceolata*. —B. Distribution of *Sonerila loeiensis*.

mensis, Fig. 2) by contrast is an umbel, the connective is enlarged into a flat ridge along the length of the thecae, and the ovary has four large apical lobes.

Phyllagathis tuberosa (Hansen) Cellinese & S. S. Renner, comb. nov. Basionym: *Tylanthera tuberosa* Hansen, Nordic J. Bot. 9: 632. 1990. TYPE: Thailand. Northern: Phitsanulok: Phu Mieng mountain, 700 m alt., July–Aug. 1966, *Larsen et al. 1105* (holotype, AAU; isotypes, BKF, C). Figure 1.

Phyllagathis siamensis Cellinese & S. S. Renner, nom. nov. Basionym: *Tylanthera cordata* Hansen, Nordic J. Bot. 9: 634. 1990. TYPE: Thailand. Central: Sarika Falls at Nakhon Nayok, 300 m alt., 1968, *Larsen et al. 3402* (holotype, AAU; isotypes, BKF, C). The new name is necessary because the epithet is occupied by *Phyllagathis cordata* Ridley. Figure 2.

Sonerila, with between 100 and 175 species (Lundin, 1983, and pers. estimate), is the largest genus in the Sonerileae. It is the only consistently trimerous genus in the family and as such easily diagnosed. Thirteen species occur in Thailand, most of them herbaceous except for *S. helferi* C. B. Clarke and *S. spectabilis* Nayar, which are somewhat woody. *Sonerila urceolata* occurs in southeast Thailand (Fig. 3A) and resembles *S. erecta* in general habit but is unusual in *Sonerila* in having urceolate capsules. The second species described here, *S. loeiensis*, is endemic to northeast Thailand (Fig. 3B) and differs from other acaulescent Thai species in having very long-petiolate membranaceous leaves, similar to those of *S. wallichii* Bennett from Mysore and *S. plagiocardia* Diels from Yunnan, species from which it differs in the much shorter inflorescence stalk.

Sonerila urceolata Cellinese & S. S. Renner, sp. nov. TYPE: Thailand. Southeast: Chantaburi, Khao Soi Dao North, Wildlife Sanctuary, Pong Namron District, 300–800 m alt., 26 Nov. 1979, *Shimizu et al. 23595* (holotype, BKF; isotypes, AAU, L). Figure 4.

A *Sonerila erecta* Jack capsula longa (8–9 mm) glabra, urceolata, basis applanatis, parte superiore fusca, persistentibus calycibus coronata differt.

Erect branched herb, to 50 cm tall and sometimes basally woody, the stem subterete, glandular-pilose mainly along two opposite longitudinal lines. Leaves of a pair subequal and slightly asymmetric, lanceolate, 1.2–4.3 × 0.6–1.5 cm, the base acute or attenuate, the apex acute to acuminate, the margin serrulate and ciliate, the lamina 3-nerved, sparsely covered by minute glands, the petiole 0.2–0.9 cm long, covered with sparse glandular hairs.

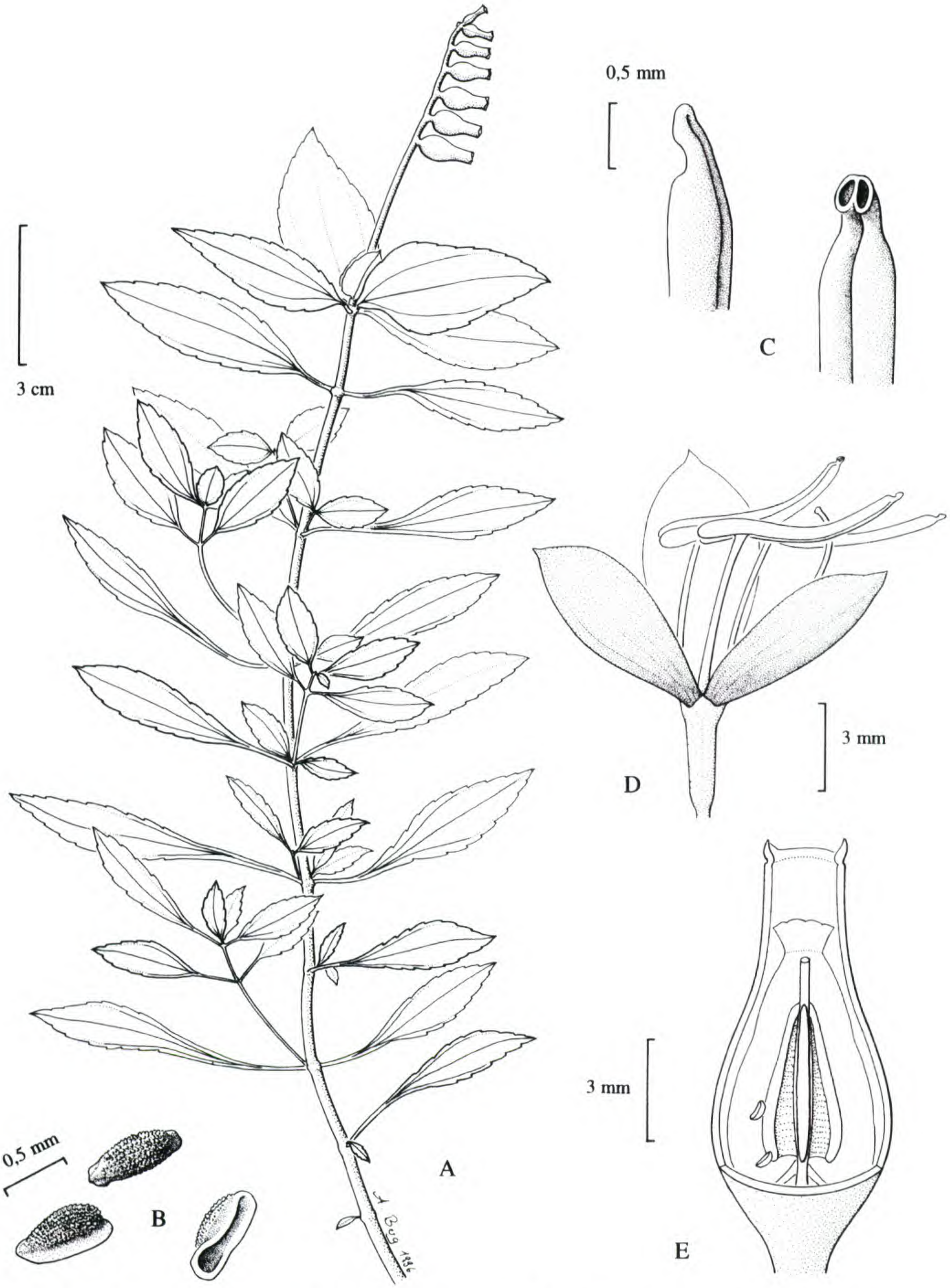

Figure 4. *Sonerila urceolata* Cellinese & S. S. Renner. —A. Habit. —B. Seeds. —C. Apical part of stamen. —D. Flower. —E. Longitudinal section of a capsule.

Inflorescence a terminal 2–7-flowered scorpioid cyme, to 3 cm long, the peduncle 2.5–5.3 cm long, subtended by two asymmetrical bracteoles. Flowers 3-merous, the pedicels 1–3 mm long. Hypanthium cylindrical, about 6.5 × 3 mm, the calyx lobes triangular, ca. 1 mm long, acuminate. Petals about 1.3 × 0.6 cm, ovate with an acuminate tip, purple. Stamens 3, the filament 7–8 mm long, the anthers about 13 mm long, opening by two pores, yellow, the pollen sacs prolonged and free at the base, with

a distinct apical constriction. Ovary about 4 mm long, adnate to the hypanthium by 3 septs, crowned by 3 conspicuous scales, the style ca. 1.4 cm long, the stigma peltate. Capsule urceolate, 8–9 × 3–5 mm, crowned by the persistent calyx lobes, glabrous, the placentae subsessile, elongated, attached to the column by several filiform stalks (in old fruits). Seeds obovate with a lateral beak, 1 mm long, tuberculate.

Flowering and fruiting: November.

Endemic to southeast Thailand where it grows in dry evergreen forest along ravines. The epithet refers to the characteristic urceolate capsules that make the species easily recognizable at least in fruit. *Sonerila urceolata* resembles the widespread *S. erecta* Jack in habit, indumentum, inflorescence type, and in having two-porate anthers. *Sonerila erecta* occurs in southeast Thailand where the new species was discovered, but has a much smaller subcylindrical capsule. Also, the old fruit placenta in *S. erecta* is distinctly stalked.

Sonerila loeiensis Cellinese & S. S. Renner, sp. nov. TYPE: Thailand. Northeast: Loei, Phu Rua National Park, summit road, vicinity of Turtle Rock, 30 Sep. 1990, *Chantaranothai et al. 482* (holotype, TCD). Figure 5.

Sonerilae wallichii Bennett affinis sed pedunculo minori differt.

Acaulescent herb, ca. 22 cm tall, the vegetative parts glabrous, rhizome short and thick. Leaves few, ovate, 2.8–8.3 × 1.6–4.5 cm, the base obliquely truncate to subcordate, the apex acute, the margin denticulate, the lamina 7-plinerved, membranaceous, the nerves reddish, the upper surface dark green, the lower surface pale green, the petiole subquadrangular, to 12.3 cm long. Inflorescence an umbel, 3–5-flowered, the peduncle 5–5.5 cm long. Flowers 3-merous, the pedicel ca. 3 mm long, with a few stiff bristly hairs. Hypanthium cylindric, ca. 5 × 2 mm, the calyx lobes triangular, less than 1 mm long, acute. Petals about 1.2 × 0.5 cm, elliptic with an acuminate tip, pink. Stamens 3, the filament 5–6 mm long, the anthers about 9 mm long, opening by a single pore, pale yellow, slender and attenuate, pollen sacs prolonged and free at the base. Ovary about 4 mm long, adnate to the hypanthium by 3 septs for about ⅔ along its length, crowned by 3 scales, the anther pockets rather deep, the style ca. 1.1 cm long, the stigma peltate. Capsule unknown.

Flowering: September.

Endemic to northeast Thailand, where it was found growing on rocks. The holotype has a teratological flower in which floral mery has doubled: it has six petals, two whorls of three equal stamens, and a six-celled ovary with two styles. As discussed above, occasional switching from one to two whorls and vice versa sometimes occurs in the Sonerileae, but we know of no published description of this particular mutation.

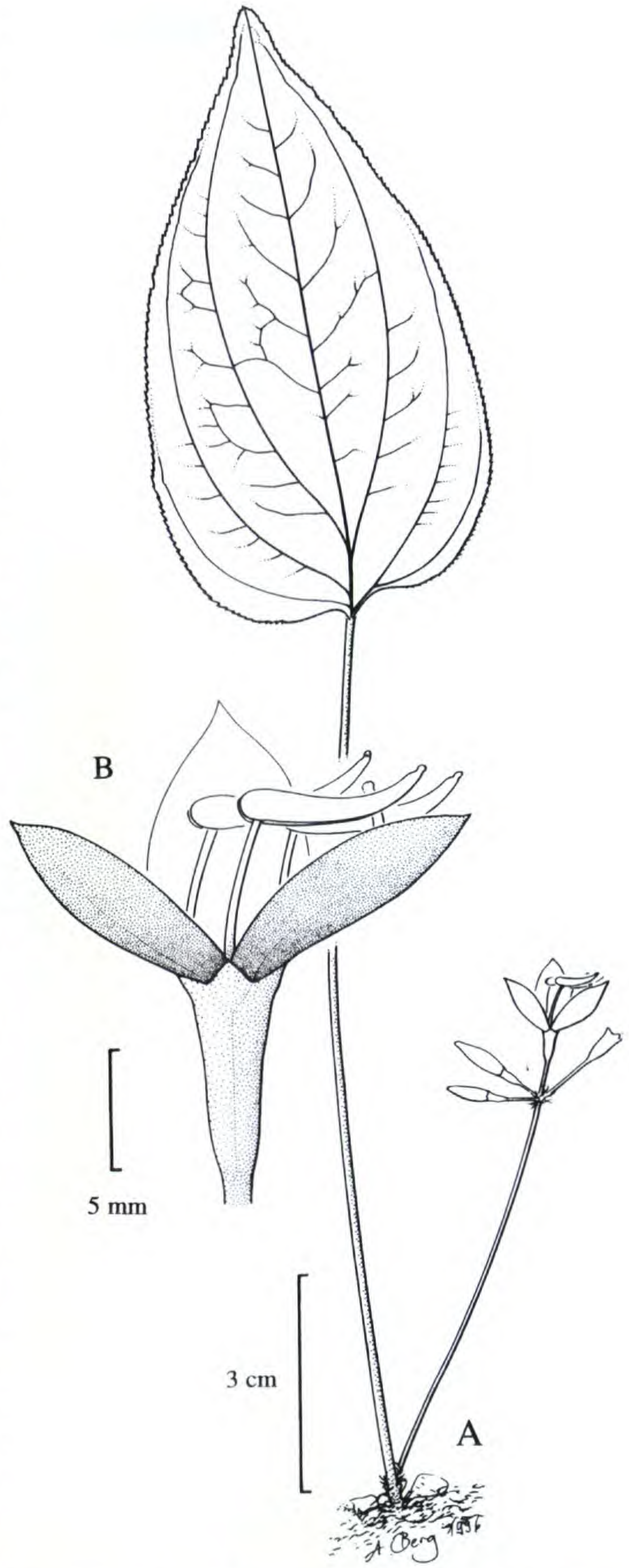

Figure 5. *Sonerila loeiensis* Cellinese & S. S. Renner. —A. Habit. —B. Flower.

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New Taxa and New Combinations in *Melaleuca* (Myrtaceae)

L. A. Craven and B. A. Barlow

Australian National Herbarium, Centre for Plant Biodiversity Research, CSIRO Division of Plant Industry, GPO Box 1600, Canberra, ACT, 2601, Australia

ABSTRACT. In advance of treatment in the *Flora of Australia* and other publications, four new taxa of *Melaleuca* are described and illustrated: *M. cajuputi* subsp. *platyphylla* Barlow, *M. clarksonii* Barlow, *M. fluviatilis* Barlow, and *M. stipitata* Craven; and two new combinations are made: *M. cajuputi* subsp. *cumingiana* (Turczaninow) Barlow and *M. squamophloia* (Byrnes) Craven.

Recent systematic studies in *Melaleuca* L. by the authors have resulted in the recognition of several taxonomic novelties and the need to refine the status of some previously described taxa. The required new names for several of these taxa are being published now as researchers in other disciplines, especially ecology, forestry, and phytochemistry, need valid names for use in publications relating to their own studies, as will the authors for the relevant generic treatment in a forthcoming volume of *Flora of Australia.*

MELALEUCA CAJUPUTI Powell

Study of material of this species from throughout its range has resulted in the conclusion that the species comprises three, geographically separate morphs for which formal taxonomic recognition at the level of subspecies is appropriate in light of the extent to which differentiation has occurred. Both Blake (1968) and Byrnes (1986) treated *M. cajuputi* as a single entity, and neither commented on the presence of any significant infraspecific variation. The three subspecies are contrasted in Table 1.

Melaleuca cajuputi subsp. **cumingiana** (Turczaninow) Barlow, comb. et stat. nov. Basionym: *Melaleuca cumingiana* Turczaninow, Bull. Soc. Imp. Nat. Mosc. 20: 164. 1847. TYPE: Malacca. *Cuming 2272* (holotype, KW (?) not seen; isotypes, BRI, CGE, K, L, LE all seen; FI, MEL, MO, P, W all not seen).

Melaleuca cajuputi subsp. *cumingiana* shows minimal overlap with the nominate subspecies in its diagnostic characters. Its leaves are wider, giving it an elliptic to ovate leaf shape, and the staminal bundle claw is consistently longer. In view of their overall similarity, and their disjunct natural distributions, they are accorded subspecific rank.

Melaleuca cajuputi subsp. *cajuputi* has been extensively cultivated in plantations for cajuput oil production, within the natural range of subspecies *cumingiana.* This may cause some confusion in the identification of specimens. Some intermediate plants may be of hybrid derivation.

Melaleuca cajuputi subsp. **platyphylla** Barlow, subsp. nov. TYPE: Papua New Guinea. Western Province: near Bula village, mouth of Morehead River, 4 Aug. 1967, *Pullen 6998* (holotype, CANB seen; isotypes, BRI seen; A, AD, BISH, BO, E, G, K, L, LAE, NSW, P, PNH, SING, TNS, US all not seen). Figure 1A–D.

A subspecie typica foliis latioribus (15–50 mm latis, 1.3–6.5plo longioribus quam latioribus), staminibus in quoque fasciculo numerosioribus (8–13), et ungue fasciculi longiore (1.1–3.5 mm longo) differt.

Shrub or tree to 30 m tall; trunk bark papery. Branchlets with moderately dense, relatively long, appressed to (mostly) spreading pubescent hairs. Leaves 45–140 mm long, 15–50 mm wide, 1.3–6.5 times as long as wide; petiole 5–15 mm long; blade with dense, appressed, sericeous hairs, elliptic, narrowly elliptic, or rarely very narrowly elliptic, the veins 5–9 and parallel. Inflorescence a spike of 8–17 triads, up to 28 mm wide; rachis pubescent. Hypanthium pubescent or puberulous, cup-shaped, 1.5–1.7 mm long, 1.7–2.5 mm wide. Sepals deciduous, glabrous on the abaxial surface, 1.1–1.5 mm long, herbaceous in the proximal-central zone and scarious in a broad marginal band, the band 0.2–0.5 mm wide. Petals 2.3–2.5 mm long, the glands circular, oblong or linear (sometimes with two very long linear glands appearing to be striations). Stamens 8–13 per bundle; filaments white, cream, or variously yellow- or whitish green, 9.2–10 mm long, the bundle claw 1.1–3.5 mm long. Fruiting hypanthium cylindrical or cup-shaped, 2.1–2.8 mm long, 2.9–3.7 mm wide. Seed 0.7–1 mm long, the cotyledons subobvolute (almost planoconvex).

Distribution and habitat. Indonesia (southeast-

Table 1. Comparison of selected characters of *Melaleuca cajuputi* subspecies *cajuputi*, *cumingiana*, and *platyphylla*.

Character	*M. cajuputi* subsp. *cajuputi*	*M. cajuputi* subsp. *cumingiana*	*M. cajuputi* subsp. *platyphylla*
Leaf width (mm)	(6–)10–16(–26)	(15–)19–28(–39)	(17–)25–50(–60)
Leaf length : width index	2.8–9.7	2.2–2.9	1.3–6.5
Stamen # per bundle	(6–)8–11(–14)	(4–)6–8(–10)	(8–)9–12(–15)
Stamen bundle claw length (mm)	1–1.6	2.1–3	1.1–3.5
Geographic distribution	Indonesia (Buru, Ceram, Tanimbar Islands, Timor), Australia (Western Australia, Northern Territory)	Burma, Thailand, Vietnam, peninsular Malaysia, Indonesia (Sumatera, western Java, southwestern Kalimantan)	Indonesia (southern Irian Jaya), Papua New Guinea (southern Papua, esp. the Trans-Fly area), Australia (Queensland)

ern Irian Jaya), Papua New Guinea (southern Papua, especially the Trans Fly area), Australia (northeastern Queensland). Occurs in lowland swamp forest, open forest on sandy soil, *Melaleuca* savanna swamp-monsoon forest ecotone, river banks adjacent to rainforest, *Melaleuca* swamp savanna on dark mottled clay, in *Ischaemum-Leptocarpus* grassland with scattered low trees and *Pandanus*, on salty swamps and mud flats at back of mangroves, and on clay pans.

Etymology. The subspecific epithet refers to the broad leaves (Greek *platys*, broad, wide, flat, level; *phyllon*, leaf).

Melaleuca cajuputi subsp. *platyphylla* does not differ as sharply from the typical subspecies as does subspecies *cumingiana* but has generally wider leaves, usually more stamens per bundle, and mostly a longer bundle claw. It represents a disjunct eastern differentiate of the species, usually growing in more humid situations. For discussion and illustration of the biogeography of the subspecies, see Barlow (1988).

Paratypes. INDONESIA. **Irian Jaya:** Merauke district, Lake Wam, 20 Aug. 1954, *van Royen 4762 p.p.* (CANB); path from Mopa Airstrip to Manggatrikke, 3 Aug. 1954, *van Royen 4559* (CANB); Djidjurug, 22 Mar. 1954, *Dijkstra BW 583* (CANB). PAPUA NEW GUINEA. **Western Province:** near Weam, 5 Aug. 1967, *Ridsdale NGF 33616* (CANB); Agu River branch of the middle Fly River, near Mipan village, 28 Sep. 1967, *Pullen 7395* (CANB); 5 km E of Bensbach River, 8°58′S, 141°18′E, 14 Aug. 1967, *Paijmans 227* (CANB); N side of Fly River, 25 km SSE of Balimo, 25 May 1972, *Paijmans 1459* (CANB). **Gulf Province:** Malalaua river wharf for Malalaua airstrip, near mouth of Tauri River, 26 Feb. 1966, *Schodde (& Craven) 4514* (CANB). **Central Province:** Nani Hill near Port Moresby, 7 Jan. 1960, *McDonald NGF 8223* (CANB); S coast near Kwikila, 13 June 1969, *Paijmans 771* (CANB). AUSTRALIA. **Queensland:** Saibai Island, ca. 1 km S of the airstrip, 23 Oct. 1981, *Clarkson 3927* (CANB); 2.5 km NE of Bamaga airstrip, 25 Aug. 1978, *Paijmans 3022* (CANB); 3.8 km from the beach on the track from the Pennefather River to the Weipa–Mapoon road, 6 Aug. 1983, *Clarkson 4926* (CANB); Claudie airstrip, ca. 4 km SSE of Lockhart River Mission, 25 Jan. 1982, *Barlow 3727* (CANB); ca. 20 km N of Josephine Creek on road to Starcke, 7 July 1985, *Barlow & Thiele 3912* (CANB); ca. 10 km SE of Daintree, near turnoff to ferry, 4 July 1985, *Barlow & Thiele 3892* (CANB); Queerah, near Cairns, 20 May 1962, *Blake 21788* (CANB).

Melaleuca clarksonii Barlow, sp. nov. TYPE: Australia. Queensland: Cape York Peninsula, 11.1 km SSE of Emu Lagoon, Alice River National Park, 7 May 1992, *Clarkson & Neldner 9582* (holotype, CANB seen; isotypes, BRI, DNA, K, L, MBA, MEL, NSW, PERTH all seen). Figure 1E–H.

A *M. leucadendra* (L.) L. cortice trunci generaliter indurata (interdum papyracea), foliis brevioribus latioribusque (30–110 mm longis, 3.3–9plo longioribus quam latioribus), et staminibus brevioribus (6–7 mm longis) differt.

Tree to 10 m tall; trunk bark hard and longitudinally fissured (sometimes papery). Branchlets with short, appressed, sericeous hairs. Leaves 30–110 mm long, 7–30 mm wide, 3.3–9 times as long as wide; petiole 3–6 mm long; blade with short, appressed, sericeous hairs, narrowly elliptic, elliptic, narrowly obovate, or obovate, the veins 5–9 and parallel. Inflorescence a spike of 9–15 triads, up to 18 mm wide; rachis minutely sericeous. Hypanthium glabrous to subglabrous (rarely with a few scattered puberulous hairs), cup-shaped, cylindrical, or funnel-shaped, 1.4–1.8 mm long, 1.3–2 mm wide. Sepals persistent (at least until the immature fruiting stage), glabrous on the abaxial surface, 0.7–1.2 mm long, herbaceous in the proximal-central zone and scarious in a narrow marginal band, the band 0.1–0.2 mm wide. Petals 1.5–2.5 mm long, the glands circular to elliptic. Stamens 6–9 per bundle; filaments creamy-white, 6–7 mm long, the bundle

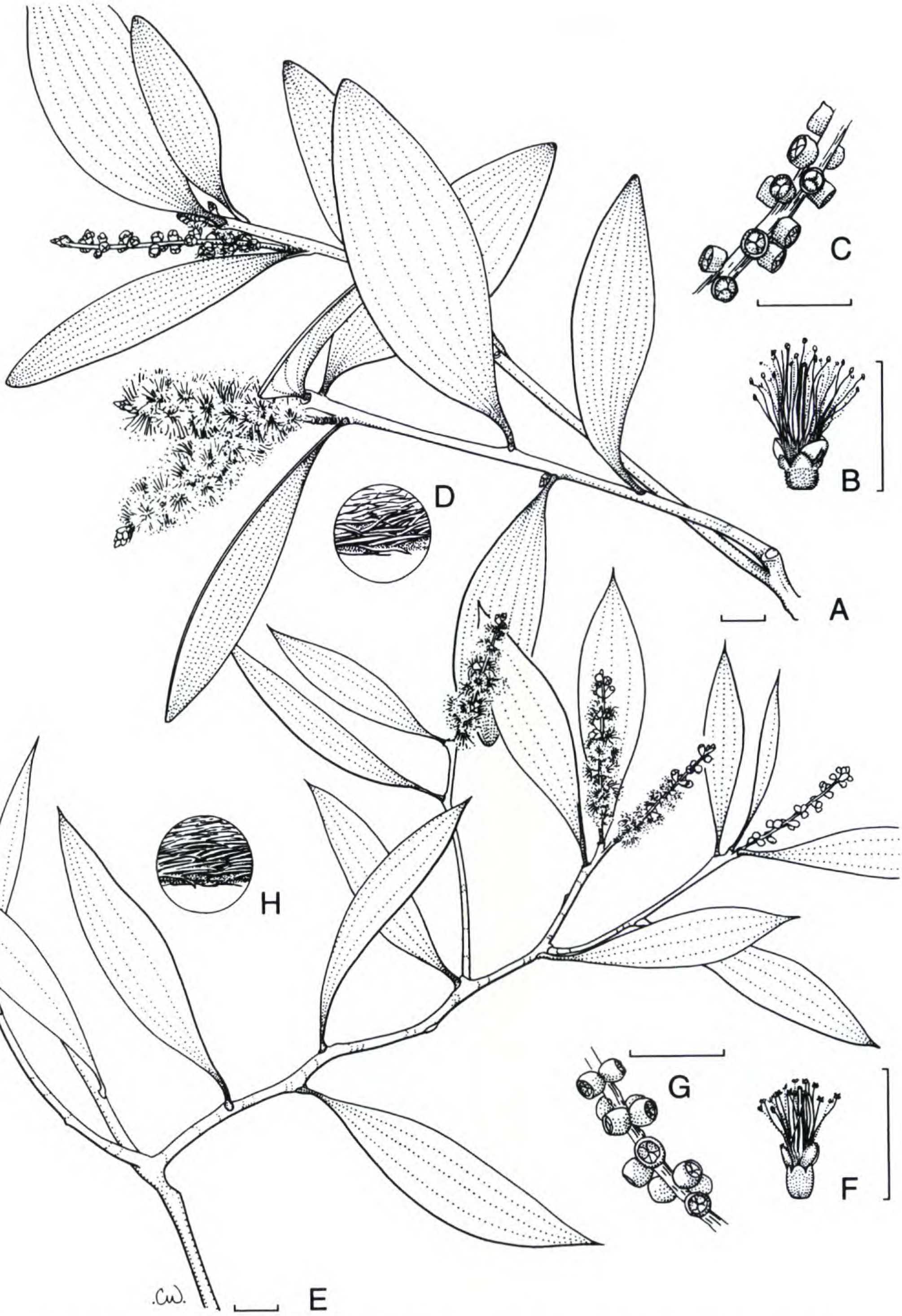

Figure 1. A–D *Melaleuca cajuputi* subsp. *platyphylla* Barlow. —A. Habit. —B. Flower, with one petal removed. —C. Portion of infructescence. —D. Detail of indumentum. A, B, D from *Pullen 6998*. C from *Paijmans 227*. E–H *Melaleuca clarksonii* Barlow. —E. Habit. —F. Flower, with one petal removed. —G. Portion of infructescence. —H. Detail of indumentum. E from *Clarkson & Neldner 9583* with inflorescences from *Clarkson & Neldner 9582*. F, H from *Clarkson & Neldner 9582*. G from *Paijmans 2880*. Scale bars = 1 cm.

claw 1.5–3 mm long. Fruiting hypanthium cup-shaped, bowl-shaped, or depressed subglobose, 2–3.5 mm long, 3–3.8 mm wide. Seed 1.1–1.5 mm long, the cotyledons obvolute.

Distribution and habitat. Western side of Cape York Peninsula, Queensland. Occurs in seasonally flooded situations on silty clay soils, often on the margins of swamps and waterholes, in woodlands or open forests and sometimes forming more or less pure stands.

Etymology. This species is named in honor of John Clarkson who has collected extensively in the monsoon woodlands and forests of Cape York Peninsula.

Melaleuca clarksonii apparently was first collected in 1966. The species can be recognized immediately when possessing hard bark as it is the only member of the broad-leaved paperbarks, to which it belongs, to have this feature. Otherwise, the extremely small flowers together with leaf shape and form are diagnostic.

Paratypes. AUSTRALIA. **Queensland:** 6 km W of Kawawah Lagoon on blazed track from Merepah to Peret, 16 Oct. 1982, *Clarkson 4572* (CANB); S of Holroyd River in lower reaches, Sep. 1974, *Webb & Tracey 13595* (QRS); Upper Christmas Creek, 18 Sep. 1974, *Hyland 7710* (CANB); 30 km N of Kalpowar Homestead, 13 Aug. 1978, *Paijmans 2880* (CANB); [type locality] 27 May 1992, *Clarkson & Neldner 9583* (CANB); Edward River Aboriginal Reserve, 20.4 km from Nutwood Crossing of the Edward River, on track to Holroyd River, 11 Oct. 1980, *Clarkson 3535* (CANB); ca. 31 km SSW of Aurukun, 0.5 km W of Aurukun-Peret track, 14 Oct. 1982, *Clarkson 4553* (CANB); 36 km W of Strathmay on Musgrave–Edward River road, 9 Oct. 1980, *Clarkson 3486* (CANB); 1.5 km E of Edward River on the road to Musgrave, 15 July 1993, *Clarkson & Neldner 10125* (CANB); 40 km SSW of Rutland Plains Homestead, 99 km S of Mitchell River mouth, 24 Aug. 1966, *Story 8038* (CANB); 15 km W of Development Road towards Monday's Yard, 3 Oct. 1985, *Jackes s.n.* (CANB).

Melaleuca fluviatilis Barlow, sp. nov. TYPE: Australia. Queensland: sandy river bed, Bruce Highway, ca. 50 km NW of Townsville, 13 July 1985, *Barlow & Thiele 3940* (holotype, CANB). Figure 2A–D.

Melaleuca nervosa (Lindley) Cheel f. *pendulina* Byrnes, Austrobaileya 2: 74. 1984. Syn. nov. TYPE: Australia. Queensland: Coen River, Coen, 3 Aug. 1948, *Brass 19778* (holotype, BRI not seen; isotypes, A not seen, CANB seen).

A *M. argentea* W. Fitzgerald lamina folii trichomatibus quorum minimum aliquot lanuginulosis vel sericeilanuginulosis, et a *M. nervosa* (Lindley) Cheel foliis angustioribus (5–19 mm latis, 5–20plo longioribus quam latioribus) et hypanthio minore (1.3–2 mm longo) differt.

Shrub or tree to 30 m tall; trunk bark papery. Branchlets variably indumented, usually with longish, straight hairs overlying short, often crisped hairs, or sometimes with ascending to spreading pubescent hairs overtopping short lanuginulose-puberulous to lanuginulose hairs, or sometimes with scattered longish pubescent hairs overlying short appressed puberulous hairs. Leaves 45–180 mm long, 5–19 mm wide, 5–20 times as long as wide; petiole 4.5–12 mm long; blade variably indumented, usually with scattered appressed to ascending longish pubescent to sericeous-pubescent hairs overlying dense lanuginulose hairs, or sometimes with a denser covering of appressed pubescent to sericeous-pubescent hairs overlying lanuginulose-puberulous hairs, or scattered longish appressed pubescent hairs overlying appressed puberulous hairs, narrowly elliptic, very narrowly elliptic, or narrowly obovate, the veins 5–7 and parallel. Inflorescence a spike of 8–18 triads, up to 40 mm wide; rachis lanuginulose-pubescent or puberulous. Hypanthium puberulous to pubescent, or lanuginulose-puberulous to lanuginulose, cup-shaped to funnel-shaped, or cylindrical, 1.3–2 mm long, 2–2.8 mm wide. Sepals usually deciduous (to persistent at least until the immature fruiting stage), hairy (puberulous to pubescent and lanuginulose-puberulous to lanuginulose) or glabrescent on the abaxial surface, 0.6–1.5 mm long, herbaceous in the proximal-central zone and scarious in a broad marginal band or herbaceous to (or almost to) the margin, the band 0–0.5 mm wide. Petals 1.5–3.5 mm long, the glands elliptic, linear, circular, or subcircular. Stamens 3–9 per bundle; filaments mostly green, sometimes cream, white, or yellow, 10–19 mm long, the bundle claw 0.5–2 mm long. Fruiting hypanthium cup-shaped, bowl-shaped, cylindrical, or barrel-shaped, 2.5–4 mm long, 3.2–6 mm wide. Seed 0.9–1.2 mm long, the cotyledons obvolute.

Distribution and habitat. Eastern Cape York Peninsula and the central-coastal area of Queensland, Australia. A typical rheophyte, it occurs along stream lines on light soils.

Etymology. The specific epithet is derived from the Latin word *fluviatilis,* which means pertaining to rivers.

Blake's (1968) circumscription of *M. argentea* includes the present species. *Melaleuca fluviatilis* differs from *M. argentea* in having longer stamens that are more strongly colored (usually green), and in the form of the leaf hairs (Barlow & Forrester, 1984 [1985]). The two species have similar habitat requirements (stream beds and banks), and a narrow

Figure 2. A–D *Melaleuca fluviatilis* Barlow. —A. Habit. —B. Flower, with one petal removed. —C. Portion of infructescence. —D. Detail of indumentum. A, B, D from *Barlow & Thiele 3940*. C from *Lazarides & Story 74*. E–G *Melaleuca stipitata* Craven. —E. Habit. —F. Flower, with one petal removed. —G. Portion of infructescence. E, F from *Brennan 1666*. G from *Slee, Craven & Brennan 2829*. Scale bars = 1 cm.

Table 2. Comparison of selected features of *Melaleuca squamophloia*, *M. bracteata*, and *M. styphelioides*.

Character	*M. squamophloia*	*M. bracteata*	*M. styphelioides*
Bark	hard	hard	papery
Leaf blade vein #	3–15	3–11	15–30
Stamen # per bundle	15–20	15–28	12–26
Ovule # per locule	40–55	30	45–55
Cotyledon form	planoconvex	obvolute	obvolute

contact zone in Cape York Peninsula (Barlow, 1988). There is no evidence of intergradation, and Barlow considered them to be sister species.

In inflorescence characters *Melaleuca fluviatilis* closely resembles *M. nervosa*, which is sympatric with both *M. argentea* and *M. fluviatilis*, but *M. nervosa* occurs predominantly in open monsoon woodlands away from watercourses. Byrnes (1986) accordingly treated some of the populations here placed in *M. fluviatilis* as *M. nervosa* f. *pendulina*. *Melaleuca fluviatilis* differs sharply from *M. nervosa* in vegetative characters as well as in ecological requirements. The new entity is as sharply distinct as other species of the *M. leucadendra* species complex, and maintains its identity in sympatry; it is accordingly given specific rank. As the taxonomic concept embodied in the above circumscription of *M. fluviatilis* differs considerably from that adopted by Byrnes (1984, 1986) for *M. nervosa* f. *pendulina*, and as the epithet "*pendulina*" can be applied to many species of the broad-leaved paperbarks, the opportunity has been taken to give the plant a more appropriate epithet now that it is recognized at the species level. Additionally, the epithet "*pendulina*" was used in the nomen nudum, "*Melaleuca pendulina* Loddiges ex Loudon" (Loudon, 1830), and, although it appears that the name has not been published validly since, it is prudent to use a different epithet.

Paratypes. AUSTRALIA. **Queensland:** 40 km N of Georgetown, 26 May 1977, *Rice 2393* (CANB); Stone Crossing-Wenlock River, 10 Oct. 1980, *Hyland 10774* (CANB); Archer River crossing on the Peninsula Development Road, 25 July 1985, *Clarkson 6039* (CANB); Edward River Aboriginal Reserve 2 km from Nutwood Crossing on track running NE along N bank of river, 11 Oct. 1980, *Clarkson 3526* (CANB); Laura River, 3 km S of Laura on the Peninsula Development Road, 23 July 1985, *Clarkson 6001* (CANB); Nigger Creek, ca. 0.25 km upstream from its junction with the Normanby River, ca. 17 km NW of Kings Plains Station, 7 Sep. 1984, *Clarkson 5541* (CANB); Mitchell River crossing between Dunbar and Koolatah, 2 Oct. 1985, *Jackes s.n.* (CANB); Walsh River crossing, on Burke Developmental Road, ca. 11 km NW of Rookwood Homestead, ca. 16 km NE of Mungana, 3 June 1983, *Conn & De Campo 1331* (CANB); bank of Burdekin River, 125 km W of Ingham, 11 Aug. 1976, *Paijmans 1900* (CANB); Betts Creek, 3 km W of Pentland township, 19 June 1953, *Perry 3535* (CANB); about WNW of Charters Towers, banks of Basalt River, near (about WSW of) Bluff Downs, 6 July 1954, *Blake 19397* (CANB); 32 km NNW of Nebo township, 27 June 1962, *Story & Yapp 81* (CANB); 5 km ENE of Warwick Homestead and 96 km NNW of Blackwater, 14 Sep. 1961, *Lazarides & Story 74* (CANB); Rockhampton, lower terrace of Fitzroy River, 12 May 1956, *Blake 19933* (CANB); 5 km SSW of Mt. Morgan, 4 July 1963, *Lazarides 6893* (CANB).

Melaleuca squamophloia (Byrnes) Craven, comb. et stat. nov. Basionym: *Melaleuca styphelioides* var. *squamophloia* Byrnes, Austrobaileya 2: 74. 1984. TYPE: Australia. Queensland: Kogan, 8 Dec. 1949, *Kerr s.n.* (holotype, BRI seen; isotypes, CANB seen, NSW not seen).

Byrnes (1986) noted that *Melaleuca styphelioides* var. *squamophloia* is, in many respects, intermediate between *M. bracteata* F. Mueller and *M. styphelioides* Smith sensu stricto and could be a hybrid. The plant, however, occurs at localities at which neither of the putative parents is found and appears to have its own geographic range. It is characterized relative to *M. bracteata* and *M. styphelioides* sensu stricto by the combination of features given in Table 2. Although its origins may have arisen in a past hybridization event, the taxon is a distinct entity and accordingly is recognized as a separate species.

Melaleuca stipitata Craven, sp. nov. TYPE: Australia. Northern Territory: below Bukbukluk lookout, 8.5 km from the Pine Creek road intersection along the Kakadu Highway, 10 Dec. 1991, *Brennan 1666* (holotype, CANB seen; isotypes, A, B, BRI, E, L, MEL, P, NSW, US all seen; DNA not seen). Figure 2E–G.

A congeneribus in combinatione characterorum sequenti differt: folia 18.5–75 mm longa, usque 4.8 mm lata, 9.1–70plo longiores quam latiores; inflorescentia spicata, usque 15 mm lata, rhachidi glabra, floribus in triadis; hypanthium distincte stipitatum, glabrum; stamina glabra, alba, 4.5–6 mm longa, fasciculo 7–14-floro; cotyledones planoconvexae.

Shrubs or trees to 4 m tall; trunk bark papery, ± tightly held. Branchlets glabrous. Leaves 18.5–

75 mm long, 0.8–4.8 mm wide, 9–70 times as long as wide; petiole 0.8–2.5 mm long; blade glabrous, the veins 3 and parallel. Inflorescence a spike of 3–10 triads, up to 15 mm wide; rachis glabrous. Hypanthium distinctly stipitate, effectively glabrous (a few puberulous hairs present at the base of the stipe), funnel-shaped, cup-shaped, or campanulate, 1.2–2 mm long, 1.2–1.6 mm wide. Sepals glabrous on the abaxial surface, 0.3–0.8 mm long, herbaceous in the proximal-central zone and scarious in a narrow marginal band, the band 0.1–0.2 mm wide. Petals 1.5–1.8 mm long, the glands circular to elliptic. Stamens 7–14 per bundle; filaments white, 4.5–6 mm long, the bundle claw 1.7–3 mm long. Fruiting hypanthium cup-shaped or cylindrical, 2.2–3 mm long, 2–2.6 mm wide. Seed 0.6–0.8 mm long, the cotyledons planoconvex.

Distribution and habitat. Upper South Alligator River area of the Top End of the Northern Territory. Woodland on shaley NW-facing hillside.

Etymology. The specific epithet is derived from the Latin word *stipitatus* and refers to the stipitate hypanthium of this species.

Melaleuca stipitata presently is known from one population only, although it can be expected to occur on similar shale country elsewhere in the upper South Alligator River area. The species apparently is unique in the genus insofar as the stipitate hypanthium is concerned. Despite their having capitate inflorescences, the closest allies of *M. stipitata* are *M. acacioides* F. Mueller, *M. alsophila* A. Cunningham ex Bentham and *M. citrolens* Barlow. The three latter species also possess smallish leaves and small white flowers, the most obvious difference being that they have flowers in heads. The basic floral unit in *M. acacioides* and *M. stipitata* is a triad, whereas in *M. citrolens* and *M. alsophila* it is a monad and dyad, respectively.

Paratypes. AUSTRALIA. **Northern Territory:** below Bukbukluk lookout, 8.5 km from the Pine Creek road intersection along the Kakadu Highway, [Type locality], 17 Oct. 1988, *Menkhorst 205* (DNA), 24 Apr. 1990, *Slee, Craven & Brennan 2829* (A, BRI, CANB, DNA, L, MEL), 6 July 1990, *Brennan 609* (CANB).

Acknowledgments. Thanks are due to the directors and curators of the following herbaria for the opportunity to study specimens in their care: BRI, CANB, CGE, DNA, K, L, LE, MBA, QRS. The dedication with which Brendan Lepschi assisted in the collection of data from specimens is greatly appreciated. Kym Brennan and John Clarkson are thanked for the special efforts they made to collect specimens of inadequately known species. The illustrations were prepared by Catherine Wardrop. The support of the Australian Biological Resources Study is gratefully acknowledged.

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New Species and Combinations in Costa Rican Orchids

Robert L. Dressler

Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.; Florida Museum of Natural History; Marie Selby Botanical Gardens. Mailing address: 21305 NW 86th Avenue, Micanopy, Florida 32667, U.S.A.

ABSTRACT. Four new species from Costa Rica are described and illustrated: *Oncidium imitans*, *Ornithocephalus grex-anserinus*, *Paphinia subclausa*, and *Scaphyglottis atwoodii*. The following new combinations are made: *Encyclia peraltensis* (Ames) Dressler, *Reichenbachanthus subulatus* (Schlechter) Dressler, *Stellilabium lankesteri* (Ames) Dressler, amd *Trichosalpinx rotundata* (C. Schweinfurth) Dressler.

As the orchid treatment for the *Manual de la Flora de Costa Rica* nears completion, several additional new species and combinations are needed. There remain a number of probable new species for which the available material is insufficient.

Oncidium imitans Dressler, sp. nov. TYPE: Costa Rica. San José: about 25 km N of San Isidro del General along the Interamerican Highway, 9°20′N, 83°41′W, 1800 m alt., tall wet evergreen forest on steep slopes, on roadside bank on moss-covered log, *W. Burger & R. Baker 10075a* (holotype, F). Figure 1.

O. obryzatoide similis sed bracteis longissimis tenuibus, sepalis lateralibus connatis, columna sine tabula infrastigmatica vel constrictione basali.

Caespitose, pseudobulbs ovoid, compressed, ca. 4 × 2 cm; leaves 1 apical, 2 sheathing, ligulate, narrowed basally, ca. 15 × 1.6 cm; inflorescence ca. 20 cm, simple, of 3–4 flowers; bracts long and narrow, thin, scape bracts 4.5–5 × 0.4–0.5 cm, floral bracts to 2.5 × 0.3–0.5 cm; sepals greenish yellow, callus white with red-brown spots, lip and petals yellow, with red on margins of isthmus and red spots on column wings; dorsal sepal elliptic, 9 × 2.5–3 mm, lateral sepals lance-elliptic, united for ca. 7 mm, together 9 × 4 mm; petals oblong-oblanceolate, obtuse, 10 × 4 mm; lip 15 × 16 mm, base with a 2-mm-wide thickening to callus, lateral lobes oblong, to 2.5 × 1.5 mm, isthmus subquadrate, 5 × 4 mm, callus 2.5 × 4 mm, 7-lobed, midlobe 6 × 15–16 mm, shallowly retuse; column 8 mm, trigonous-terete, without tabula infrastigmatica, wings ca. 1.5 × 3.5 mm.

I first encountered this species in the Jardín Lankester, where a plant from Santa María de Dota was labeled as *O. obryzatoides* Kraenzlin. My wife and I photographed the flowers and preserved a couple in liquid, without questioning the identification. When I later studied *O. obryzatoides*, it was immediately obvious that the plant from Santa María de Dota was distinct. The long bracts, the column without a tabula infrastigmatica, and the partially united lateral sepals all suggest *O. warscewiczii* Reichenbach f. *Oncidium imitans* may prove to be a natural hybrid of *O. warscewiczii*. It has been collected it two localities, in each case identified as *O. obryzatoides*. Though superficially similar to *O. obryzatoides*, the column without either tabula infrastigmatica or basal constriction and the connate lateral sepals at once distinguish *O. imitans*. The epithet, *imitans*, refers to its superficial similarity to *O. obryzatoides*.

Ornithocephalus grex-anserinus Dressler & Mora-Retana, sp. nov. TYPE: Costa Rica. Alajuela: dist. Sarapiquí, alrededores de Laguna María Aguilar, elev. 500–700 m, 10°18′N, 84°11′O, 5 mayo 1992, *D. E. Mora-Retana, F. Pupulin & A. Herrera s.n.* (holotype, USJ 49975). Figure 2.

Habitu genere, sepalis ovatis carinatis apiculatis, petalis cuneato-unguiculatis spathulato-flabellatis, labello pandurato-oblongo callo humili.

Plant psygmoid, leaves linear-lanceolate, subfalcate, acuminate, 4.2–8 × 0.3–0.5 cm, abscission layer ca. 5 mm from base; inflorescence lateral, 8–9 cm, rachis fractiflex, bracts triangular-ovate, cordate, acute, keeled, glandular-erose, 2–3 mm; ovary and pedicel 6–7 mm; sepals ovate, carinate, apiculate, laterals reflexed, 3–3.2 × 2–2.2 mm; petals cuneate-unguiculate, truncate-subspatulate, 6 × 5.6 mm; lip 9 × 3.2 mm, lateral margins recurved, callus 3 × 2.8 mm, cordate, ovate, distally continuous with surface of blade; shaft of column ca. 0.8 mm, anther with rostellar beak ca. 3 mm.

A single plant of this species was found by the

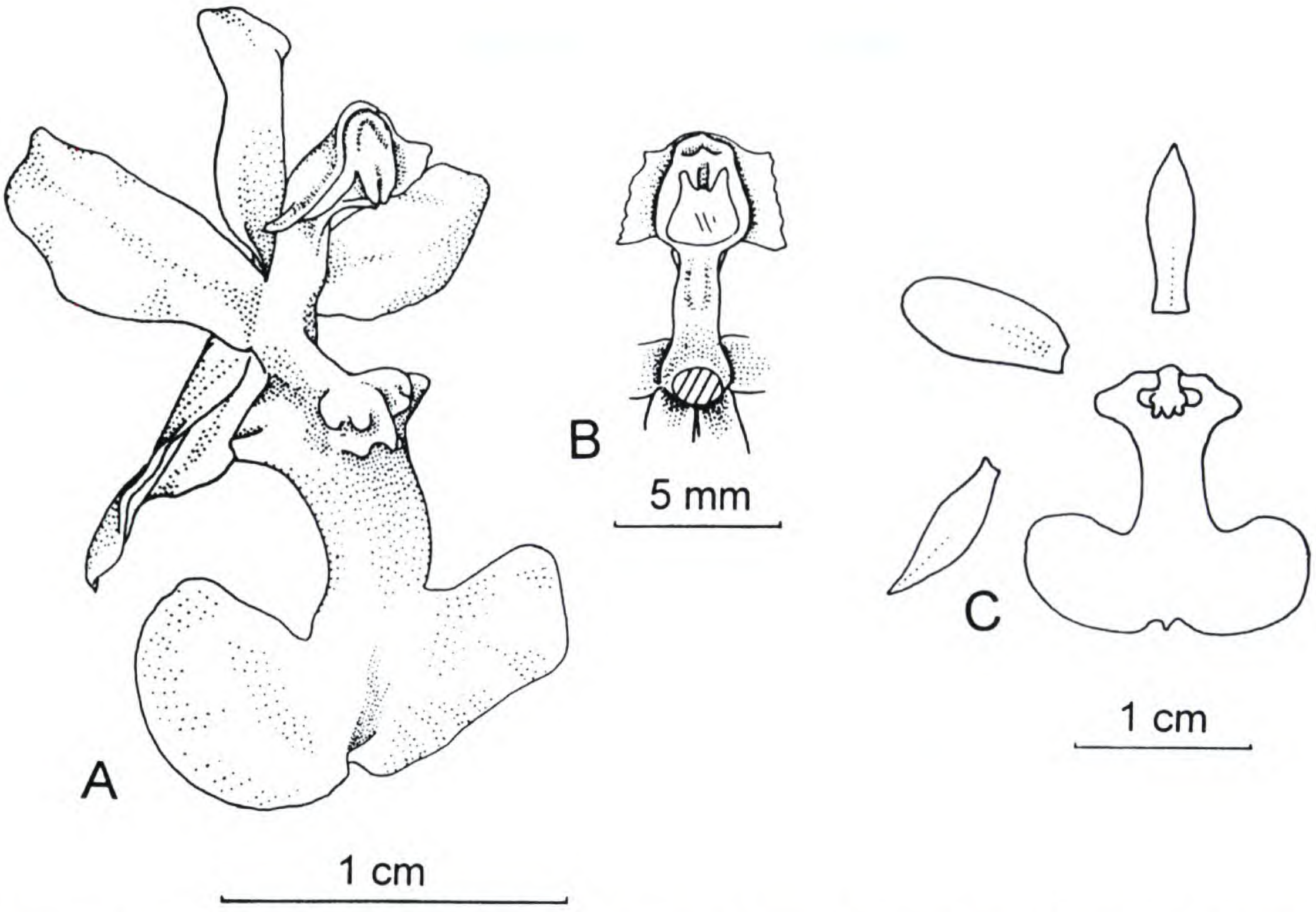

Figure 1. *Oncidium imitans* Dressler. —A. Lateral front view of flower. —B. Ventral view of column. —C. Perianth parts flattened. Based on liquid-preserved material of plant cultivated in Jardín Lankester (FLAS).

collectors when seeking *Macroclinium*. When the plant flowered in cultivation, it proved to be so unusual that we do not hesitate to describe it as a new species. To date, no other plants of this species have been found.

Ornithocephalus grex-anserinus is distinct in the spreading, subspatulate petals, the reflexed sepals, and the simple lip with the median surface of the callus continuous with the blade. The inflorescence with spreading wing-like petals reminds one of a flock of migrating geese, to which the epithet alludes.

Paphinia subclausa Dressler, sp. nov. TYPE: Costa Rica. Reserva Juan Castro Blanco, 900 m, sobre troncos grandes, ago. 1989, *Dora E. de Retana* (holotype, USJ). Figure 3.

P. rugosae similis sed pede columnae brevi, floribus albidis subclausis, lobo intermedio labello angustiore.

Caespitose, pseudobulbs ovoid, smooth, somewhat compressed, subtetragonous, 2.5–3.5 × 1.5–2 cm; leaves 2, thin, plicate, elliptic, subpetiolate, 17–22 × 2.7–6 cm; inflorescence pendent, 8–15 cm, with 3–6 flowers; floral bracts 12–14 × 6–8 mm; pedicel with ovary 4.5–5 cm; sepals lanceolate or elliptic-lanceolate, acuminate, 3.5–5 × 1.2–1.6 cm, petals similar, 3–3.7 × 1–1.3 cm; lip 3-lobed, cuneate, 2.5–3.7 × 1.2–1.5 cm, lateral lobes obliquely subquadrate (resembling a shark fin), antrorse, acute, 4–5 × 6–7 mm, midlobe 3-lobulate, 9–10 × 8–9 mm, widest across basal lobules, midlobule oblong, with few small, erect keels and 2 erect clavate appendages between lateral lobes, distally fimbriate with many clavate, verruculose appendages ca. 4 mm long; column 17–20 mm, arcuate, winged.

When C. H. Dodson and I found a white-flowered *Paphinia* between Turrialba and Siquirres in 1965, it was thought to be the plant described as *P. cristata* var. *modiglianiana* Reichenbach f. (Fowlie, 1964). Flowers were kept in fresh condition as long as possible to attract pollinators for photography and identification, so the flowers available for pressing were few and rather battered. The lack of an adequate type specimen was one reason that I treated *P. clausula* as a new name, based on *P. cristata* var. *modiglianiana*, rather than a new species. Now, both Jenny (1979) and Dodson and Neudecker (1990) have studied the European herbarium material and found that *P. cristata* var.

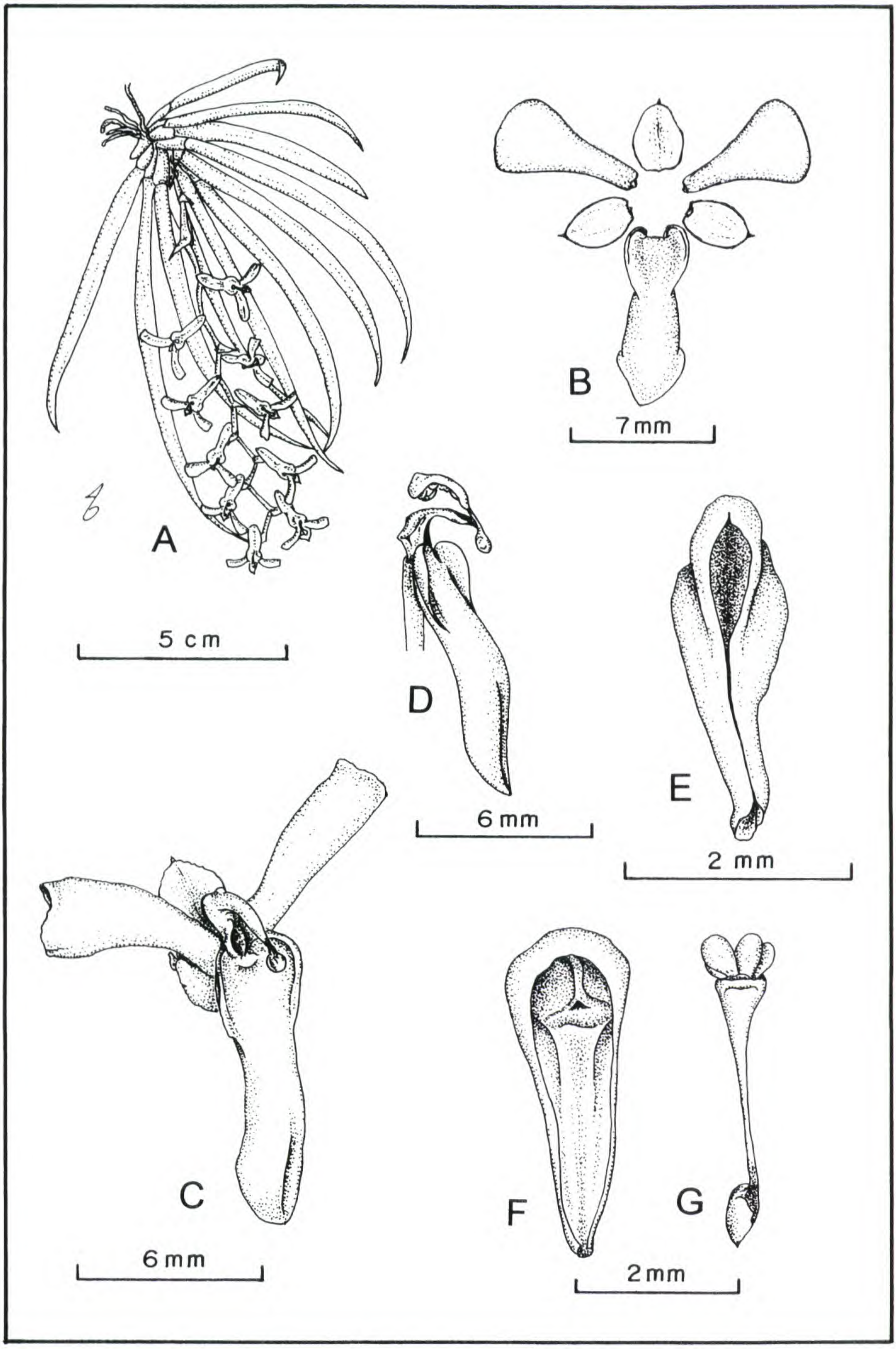

Figure 2. *Ornithocephalus grex-anserinus* Dressler & Mora-Retana. —A. Habit. —B. Perianth parts, spread. —C. Flower front view. —D. Lip and column. —E. Column, dorsal view. —F. Anther. —G. Pollinarium. Based on living material of type plant.

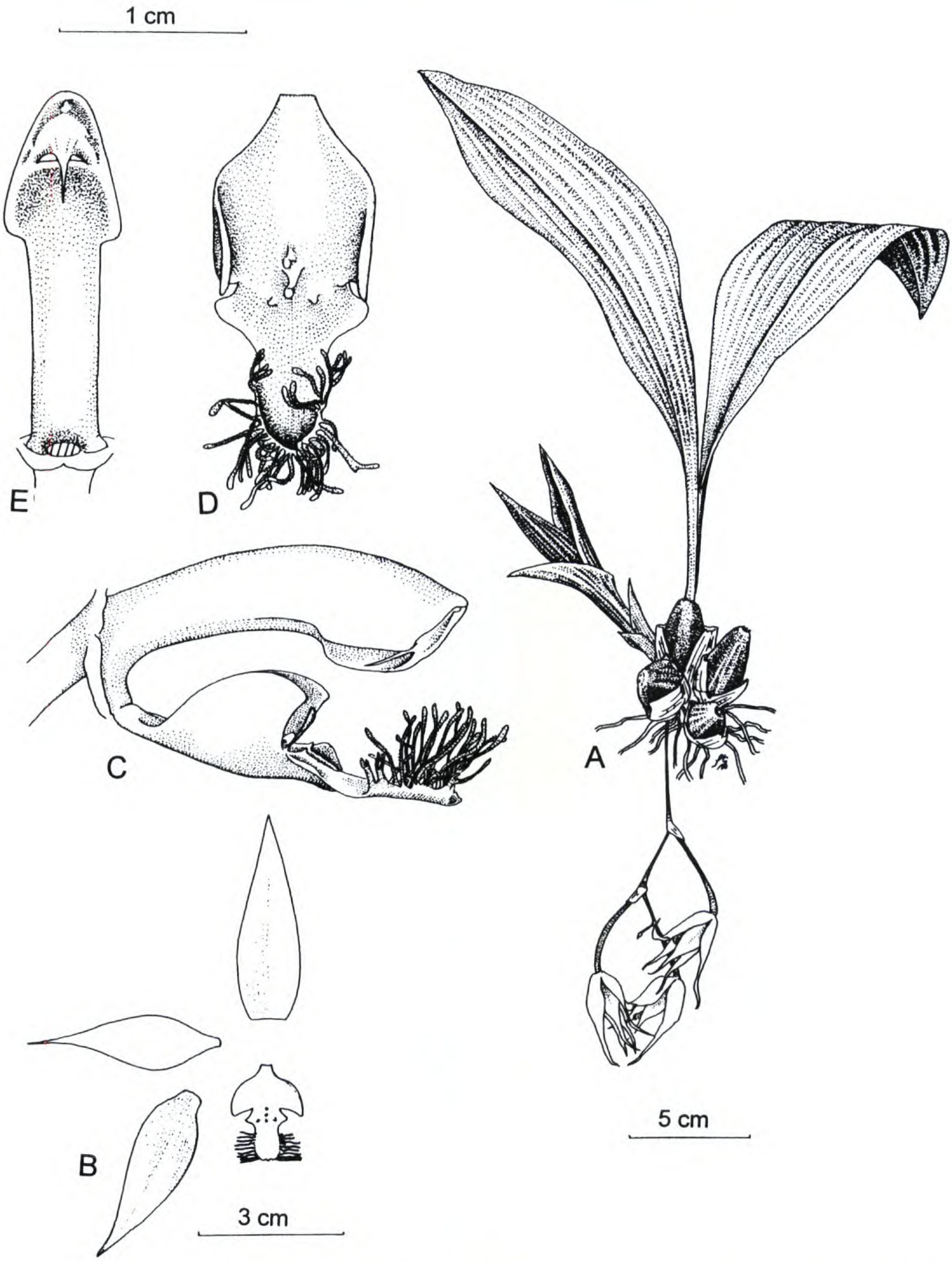

Figure 3. *Paphinia subclausa* Dressler. —A. Habit. —B. Perianth parts spread. —C. Lip and column, lateral view. —D. Lip in natural position. —E. Column, ventral view. Based on living and liquid-preserved material of a plant collected near Turrialba.

modiglianiana is, indeed, a white-flowered form of *P. cristata* from Brazil. As the name *P. clausula* is irrevocably tied to the type of *P. cristata* var. *modiglianiana*, the Costa Rican *Paphinia* must be described as new. Fortunately, an excellent type specimen is now available.

Paphinia subclausa is distinctive in the short column foot, lack of appendages or lobules at the base of the lip, and its white, half-closed flowers. These features suggest a close alliance with *P. rugosa* Reichenbach f. and *P. neudeckeri* Jenny, both species with pale forms in Colombia (Dodson & Neudecker, 1990).

Scaphyglottis atwoodii Dressler, sp. nov. *Scaphyglottis gracilis* sensu Atwood (Icones Plantarum Tropicarum 14: 1391. 1989), non Schlechter. TYPE: Costa Rica. Heredia: 3 km E of Puerto Viejo de Sarapiquí, Finca La Selva, 50–150 m, 27 Oct. 1979, *C. Todzia 962* (holotype, MO). Figure 4.

S. bilineatae similis sed base labello cum pede columnae minuto sigmoideo, lobo intermedio labello flabellato papilloso eroso-denticulato, apice columna leviter deflexa in media alis.

Stems slender, superposed, basal stems 6–20 cm, basally with sheaths bearing caducous, reduced leaf blades; leaves oblong or elliptic-oblong, 5.5–9.5 × 0.6–1.1 cm; flowers solitary or fascicled, bracts oblong, brown, conduplicate, 5–7 × 3–4 mm; sepals narrowly oblong, acute, 6 × 1.6–2 mm; petals ligulate, 6 × 0.7–1 mm; lip cuneate, 6 × 3.5–4 mm, shallowly 3-lobed, lateral lobes decurrent, 0.5 × 2 mm, midlobe subflabellate or transversely rhombic, verruculose, base of lip abruptly bent upward, paralleling column foot, and then forward; column ca. 6 mm, with prominent wings, bent at the wings.

Atwood identified these plants as *Scaphyglottis gracilis* Schlechter. Though the protologue shows none of the unique features of that species, Schlechter's drawing of the flower could be taken to represent *S. atwoodii.* A tracing of the plant (AMES), however, shows much narrower leaves, indicating that *S. gracilis* is a synonym of *S. prolifera* Cogniaux. *Scaphyglottis atwoodii* resembles *S. bilineata* (Reichenbach f.) Schlechter in most features but is easily separated by (1) the abruptly bent base of the lip, which, with the column foot appears to form a nectary, (2) the flabellate midlobe of the lip with papillose surface and erose-denticulate distal margin, and (3) the spoon-like column apex bent at the wings. The plants appear to be autogamous, flowering and setting fruits irregularly.

This species is known only from Finca La Selva, where there have been several collections. Plants collected in nearby Chilamate proved to be *S. bilineata*, a species not recorded from La Selva.

Paratypes. COSTA RICA. **Heredia:** all from Finca La Selva: *J. Folsom 8818* (DUKE), *9156* (DUKE), *10128* (DUKE), *C. Todzia 842* (CR), *1084* (DUKE).

New Combinations

Encyclia peraltensis (Ames) Dressler, comb. nov. Basionym: *Epidendrum peraltense* Ames, Sched. Orch. 1: 46. 1922. TYPE: *C. H. Lankester & A. Sancho 378* (holotype, AMES).

This may prove to be a natural hybrid, of which only a few collections have been made from the Atlantic slope of Costa Rica. Until its parentage can be determined, it should at least be treated with the rest of its congeners, in *Encyclia.*

Reichenbachanthus subulatus (Schlechter) Dressler, comb. nov. Basionym: *Scaphyglottis subulata* Schlechter, Repert. Spec. Nov. Regni Veg. 8: 454. 1910. TYPE: *A. Biolley 1367* (holotype, B presumably destroyed).

The drawing, supposedly of this species, that was published (Repert. Spec. Nov. Regni Veg. Beih. 59: t. 44) proves to be a drawing of *S. brachiata* Schlechter (= *S. stellata* Loddiges ex Lindley). There is, however, a photograph of the type in the Ames Herbarium, and this is clearly what was described as *Hexisea lankesteri* Ames, for which the combination *Reichenbachanthus lankesteri* (Ames) Mora-Retana & J. García was only recently published. *Scaphyglottis subulata*, however, is earlier by a number of years, and so the epithet *subulatus* must be used for this species.

Stellilabium lankesteri (Ames) Dressler, comb. nov. Basionym: *Telipogon lankesteri* Ames, Sched. Orch. 3: 23. 1923. TYPE: *C. H. Lankester 361* (holotype, AMES).

Unfortunately, the number of type specimens of *Stellilabium* is not much less than the total number of specimens available. Each, however, appears to be distinct and thus this new combination is needed.

Trichosalpinx rotundata (C. Schweinfurth) Dressler, comb. nov. Basionym: *Pleurothallis rotundata* C. Schweinfurth, Bot. Mus. Leafl. 4: 115. 1937. TYPE: *A. A. Hunter & P. H. Allen 561* (holotype, AMES).

I had no intention of poaching in Carl Luer's

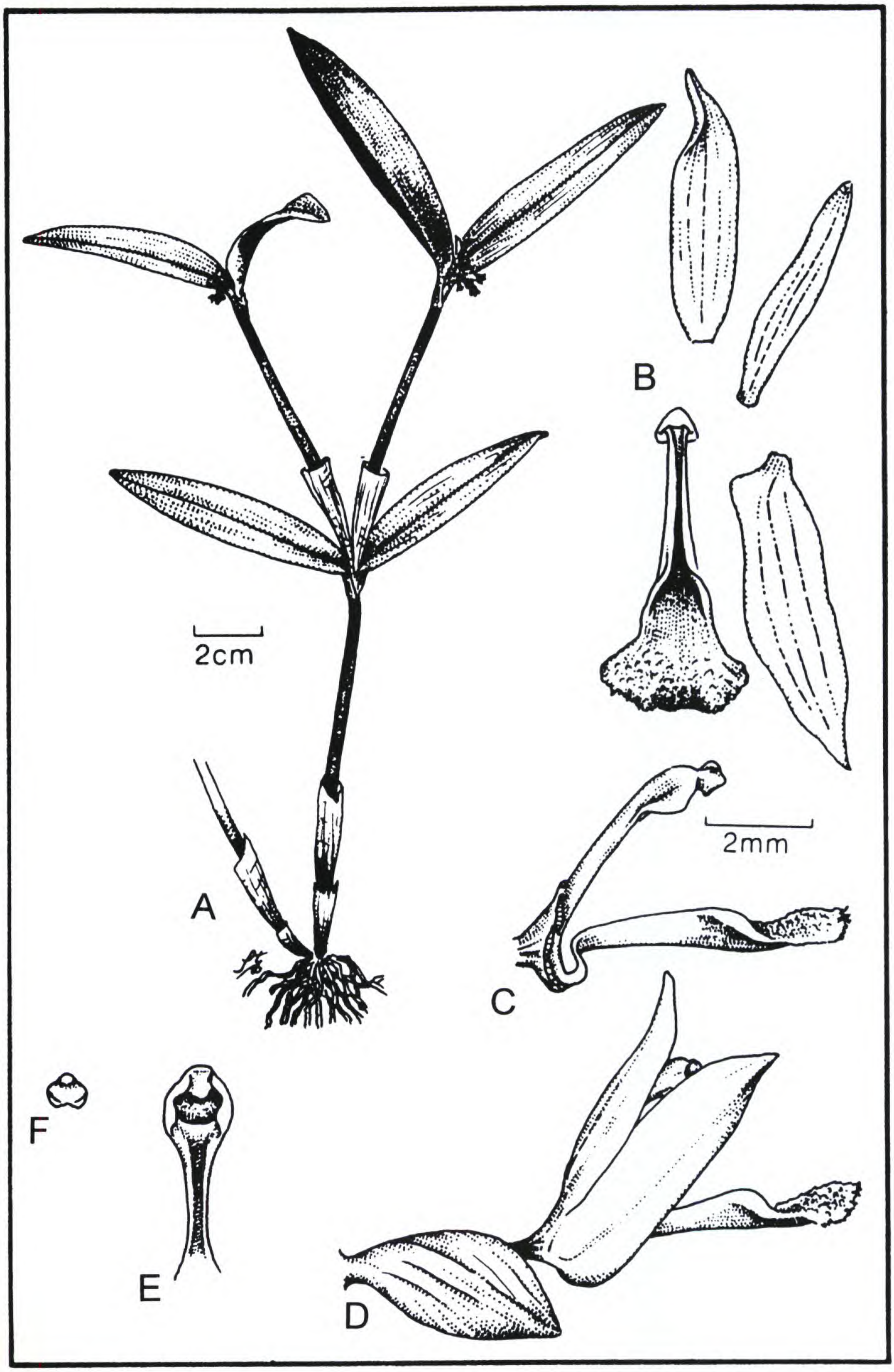

Figure 4. *Scaphyglottis atwoodii* Dressler. —A. Habit. —B. Perianth parts. —C. Lip and column, lateral view. —D. Flower and bract. —E. Column, ventral view. —F. Anther. Based on *Folsom 9156* and *Todzia 1084*.

area, but he somehow thought I would publish this combination and so left it to me.

Acknowledgments. I am indebted to Stig Dalström and Omar Achí for the preparation of the drawings used here and to John Atwood for permission to use the drawing of *Scaphyglottis atwoodii*. Recent fieldwork has been supported by the National Science Foundation and the Office of Forestry, Environment and Natural Resources, Bureau of Science and Technology, of the U.S. Agency for International Development under NSF Grant DEB-9200812 (to John Atwood).

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Omphalea (Euphorbiaceae) in Madagascar: A New Species and a New Combination

Lynn J. Gillespie

Canadian Museum of Nature, P.O. Box 3443, Station D, Ottawa, Ontario K1P 6P4, Canada

ABSTRACT. *Omphalea ankaranensis*, a shrub endemic to limestone karst hills of northern Madagascar, is described and illustrated. The species is closely related to *Omphalea palmata* Leandri of western Madagascar but differs in its entire to coarsely crenate-dentate leaf blade margins, broader inflorescence bracts, lax cymules, and shorter pistillate flower pedicels. The new combination *Omphalea oppositifolia* (Willdenow) L. J. Gillespie is made for the widely distributed rainforest species of eastern Madagascar, previously known as *Omphalea biglandulosa* Persoon. A synopsis including new lectotypifications and a key to the four Madagascan species of *Omphalea* is provided.

Omphalea L. is a genus of ca. 17 species belonging to the Euphorbiaceae. Six species are canopy lianas, while the remaining species range in habit from shrubs to large canopy trees. The genus is known from the Neotropics, southeast Asia to northeast Australia, Tanzania, and Madagascar, with centers of diversity and endemism in the Caribbean (6 species, 5 endemic) and in Madagascar (4 species, all endemic). While several species are widespread, the majority have limited ranges and some are quite rare. Species occupy a diversity of habitats from lowland rainforest, wet montane forest, to dry forest and thicket on limestone and sandy soils.

The genus is characterized by an androecium of two or three stamens with connate filaments, styles that are completely fused into a usually massive stylar column, large foliaceous inflorescence bracts, and a complex inflorescence architecture. Inflorescences are technically thyrses and consist of spicate, racemose, or paniculate main axes that bear numerous cymules. These cymose units may be glomerate to lax and each is subtended by a usually foliaceous bract (note that bracteoles are defined as subtending axes within a cymose unit). Other features common in the genus but rarely found elsewhere in the family include red latex, liana habit with tendril-like climbing stems, mushroom-shaped androecia, and large fruits.

Omphalea has long been considered a well-defined genus and one that is rather isolated in the Euphorbiaceae. The genus has been allied with genera that belong to all three uniovulate subfamilies in Webster's classification (1975, 1994). In the past *Omphalea* was usually placed in either tribe Hippomaneae (Baillon, 1858, as tribe Excaecarieae; Pax & Hoffmann, 1912), which is included in Webster's subfamily Euphorbioideae, or tribe Gelonieae (Mueller, 1866; Pax & Hoffmann, 1931; Hutchinson, 1969), a heterogeneous grouping of genera belonging to all three uniovulate subfamilies. More recently, Webster (1994) treated the genus as the monogeneric tribe Omphaleae, close to tribe Plukenetieae in subfamily Acalyphoideae. In contrast, Airy Shaw (1980) included the genus in his tribe Jatropheae (which comprises genera placed by Webster in subfamily Crotonoideae) in his tentative scheme for natural grouping of genera. Recent preliminary evidence from molecular and specialist herbivore phylogenetic studies appears to support a relationship with members of subfamily Crotonoideae (Wurdack & Chase, 1996; Lees & Smith, 1991). Its isolated position and unusual combination of plesiomorphic (e.g., extrastaminal disc, imbricate staminate sepals) and derived (e.g., presence of laticifers, foliaceous bracts, few connate stamens, entirely connate styles) character states suggest that *Omphalea* may represent a relatively early evolutionary branch within the uniovulate euphorbs (Gillespie, 1988b), perhaps near the base of subfamily Crotonoideae.

Three species of *Omphalea* were previously known from Madagascar. The east coast rainforest tree *O. oppositifolia* (Willdenow) L. J. Gillespie was first collected, illustrated, and described as the genus *Hecatea* by Du Petit-Thouars (1804a, 1804b, 1805) and formally named as a species by Willdenow (1805) in the early 1800s. Much later, Leandri (1938) described two dry forest species, *O. occidentalis* and *O. palmata*, from the west coast of Madagascar. A fourth species was recently discovered by the author on limestone karst in the Réserve Speciale Ankarana in northern Madagascar. A specimen of this new species from Montagne des

Français, just south of Antsiranana (Diego Suarez), was subsequently found in the Paris Herbarium.

Phylogenetic studies of the genus suggest that the Afro-Madagascan and neotropical species form a clade defined by a complex of male floral characters including a mushroom-shaped androecium (Gillespie, 1988a, b; Fig. 1D). There appear to be two major lineages within this clade based primarily on leaf architectural characters (for leaf architectural terminology refer to Hickey, 1975, 1979). The first culminates in leaves having palmate primary venation and highly organized secondary and higher order venation, while the second is characterized by leaves with pinnate primary venation and relatively disorganized secondary and higher order venation. These two lineages correspond (excluding the Australasian species) to Pax and Hoffmann's sections *Palmatinerviae* and "Penninerviae" (= sect. *Omphalea*) respectively. Both are represented in Madagascar. The east coast wet forest species *O. oppositifolia* is the sole palaeotropical member of the clade characterized by pinnately veined leaves. The three western and northern Madagascan dry forest species, *O. ankaranenis*, *O. occidentalis*, and *O. palmata*, together with the single African species *O. mansfeldiana* Mildbraed, comprise the palaeotropical members of the palmate clade. According to the above phylogenetic hypothesis the shrub/tree habit apparently evolved from the plesiomorphic state of liana habit at least three times in the genus (Gillespie, 1988b). All Madagascan species are shrubs or trees, while the Tanzanian species *O. mansfeldiana*, most closely related to the Madagascan dry forest species, is a liana. This suggests that the shrub/tree habit of *O. oppositifolia* may have evolved independently of that habit in the Madagascan dry forest species. A second character state that appears to have evolved more that once is foliar gland pair positioned abaxially at the blade-petiole junction (Fig. 5), the only state unique to all five Afro-Madagascan species (all neotropical and Australasian species have the gland pair positioned adaxially). The above phylogenetic hypothesis would suggest that the abaxial state was derived independently in the two lineages.

Omphalea has an interesting association with the moth subfamily Uraniinae. Species of the genus are the primary larval foodplants of the three large diurnal moth genera, *Urania* Fabricius, *Chrysiridia* Hübner, and *Alcides* Hübner (Lees & Smith, 1991). Secondary compounds present in *Omphalea* (such as polyhydroxy alkaloids, Kite et al., 1991) and selectively sequestered by the larvae are thought to have set the stage for the evolution of the adult moths' aposomatic appearance (Coleman & Monteith, 1981; Lees & Smith, 1991). Larvae of the Madagascan endemic *Chrysiridia ripheus* (Drury) have been observed to feed on all four species of *Omphalea* in Madagascar (Lees & Smith, 1991; Lees & Gillespie, pers. obs.). This large colorful moth known as the Sunset Moth is both collected in the wild and raised commercially for the international butterfly trade. Individual moths appear to migrate throughout Madagascar apparently among populations and species of *Omphalea*, suggesting that *C. ripheus* may be dependent on all four Madagascan species of *Omphalea* for its survival.

KEY TO THE SPECIES OF *OMPHALEA* IN MADAGASCAR

1a. Leaf blades elliptic, oblong or obovate, pinnately veined; bracteoles leaf-like, petiolate, to 3.5 cm long, resembling the bracts; inflorescence paniculate or sometimes racemose . . . 3. *O. oppositifolia*

1b. Leaf blades cordiform to ovate, palmately veined; bracteoles triangular, less than 0.5 cm long; inflorescence spicate, racemose, or rarely paniculate (and then branches spicate).

2a. Inflorescence spicate, cymes highly condensed and glomerate; bracts highly reduced, triangular, less than 0.5 cm long; plant mostly covered in a dense velvety pubescence; leaf blades 12–38 cm long . . . . . 2. *O. occidentalis*

2b. Inflorescence racemose, cymes condensed to lax; bracts elliptic to linear, mostly longer than 2 cm; plant glabrous to sparsely pubescent; leaf blades 6–16 cm long.

3a. Cymes condensed, appearing glomerate; pistillate flower pedicel 2–4 mm long; bracts epetiolate, linear or very narrowly oblong; inflorescence strongly recurved at base, pendent; leaf blades sparsely pubescent or very sparsely pubescent, entire to often deeply palmately lobed . . . . . 4. *O. palmata*

3b. Cymes lax, flowers terminating divaricate axes ca. 0.4–1(–2) cm long; pistillate flower pedicel to 0.5 mm long; bracts petiolate, blade elliptic or lanceolate; inflorescence not recurved at base, erect to pendent; leaf blades glabrous or glabrescent, entire to sometimes coarsely crenate-dentate . . . . . 1. *O. ankaranensis*

1. Omphalea ankaranensis L. J. Gillespie, sp. nov. TYPE: Madagascar. Prov. Antsiranana: Réserve Speciale Ankarana, limestone tsingy near Camp Anglais, 7 km SE of Matsaborimanga, 12°54′S, 49°07′E, ca. 150 m, 27 Nov. 1990 (fl), *Lynn Gillespie 4064* (holotype, MO; isotypes, CAN, K, P, TAN, US). Figures 1–4.

Differt a *O. palmata* Leandri foliis marginibus integris

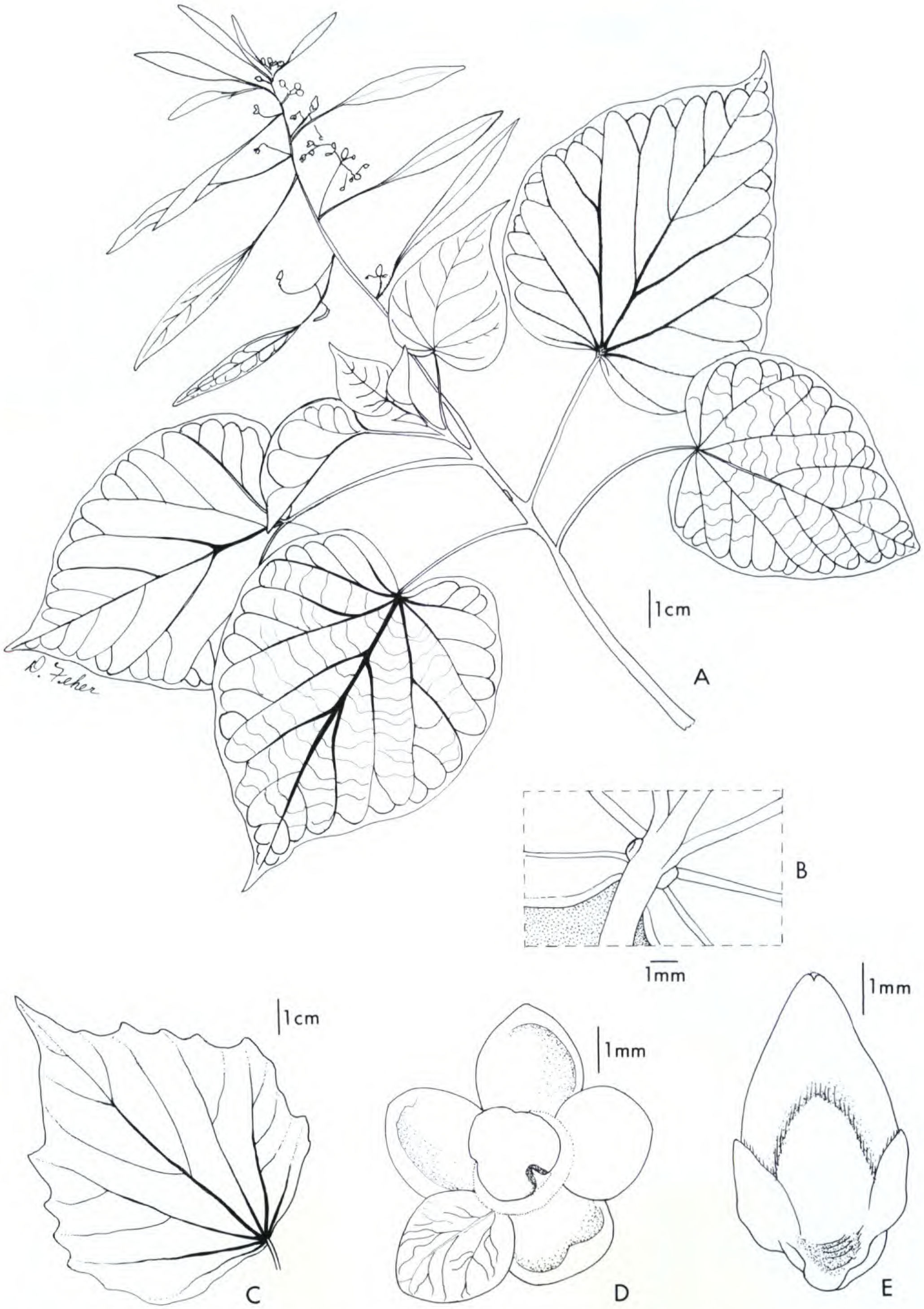

Figure 1. *Omphalea ankaranensis* L. J. Gillespie. —A. Flowering branch; note bracts subtending cymose units. —B. Gland pair on abaxial leaf surface. —C. Leaf with coarsely and irregularly crenate-dentate margins. —D. Staminate flower. —E. Pistillate flower. (A, B, D, E based on *Gillespie 4064*; C based on *Gillespie 4078*.)

Figures 2–7. 2–4. *Omphalea ankaranensis.* —2. Flowering branch. —3. Vegetative branch showing leaves with coarsely crenate-dentate margins. —4. Inflorescence. 5–7. *Omphalea palmata.* —5. Gland pair on abaxial leaf surface. —6. Vegetative branch with entire to lobed leaf blades. —7. Vegetative branch with deeply palmately lobed leaf blades. (2, *Gillespie 4064*; 3, 4, *Gillespie 4078*; 5, 6, *Gillespie 4167*; 7, *Gillespie 4168*). Scale bar = 5 cm in Figures 2, 3, 6, 7; bar = 2 cm in Figure 4; bar = 2 mm in Figure 5.

vel repandis vel crenato-dentatis, inflorescentiis basi non recurvatis, cymis laxis in axibus divaricatis, bracteis petiolatis lamina elliptica vel lanceolata et pedicellis florum femineorum brevioribus.

Shrub or small tree 1–7 m tall, trunk often enlarged and sometimes bulbous at base; branches slender, glabrous, brick-colored when dry with whitish leaf scars; young shoots glabrous; latex red; foliage deciduous, leaves spirally clustered on ascending branch tips. Leaf blade cordiform or narrowly cordiform, 7–16 cm long, 5–12 cm wide, attenuate or long-acuminate at apex, cordate at base with sinus 0.5–2.3 cm deep or rarely truncate with sinus absent, chartaceous, glabrous or glabrescent, margin entire, repand, or sometimes irregularly and coarsely crenate-dentate; venation palmate with 5 primary veins, basal veins 7; secondary veins brochidodromous, rarely craspedodromous and then only in crenate-margined leaves, intersecondary veins absent; tertiary veins weakly percurrent, sometimes forked or ramified, not strongly recurved; higher order veins random-reticulate or ramifying; glands elliptic or suborbicular in outline, 0.7–1.2 mm diam., cup-shaped, disciform, or slightly raised with flat surface, at junction of petiole and primary veins, abaxial; laminar glands absent or present at lobe apices in crenate-dentate margined leaves, suborbicular, ca. 0.4 mm diam., submarginal; petiole 3–10 cm long, slender, glabrous or glabrescent. Inflorescence a racemose thyrse, 3–13 cm long, erect to pendent, axes glabrous, main axis determinate and often terminating in either a staminate or pistillate flower. Cymes lax with 2–4 orders of branching, branches divaricate with angle of divergence 90° or more; primary cyme axis 4–11 mm long (to 20 mm long in basal cymes) with two terminal subopposite branches; secondary axes 3–10(–14) mm long with two terminal subopposite branches, higher order axes to 10 mm long with 1–2 terminal branches. Bracts (3–)4–8.5 cm long, green, glabrous; blade narrowly elliptic, narrowly rhombic, or lanceolate, (2–)3–5.5 cm long, (0.3–)0.5–1.4 cm wide, acute or attenuate at apex, decurrent at base, margin entire; venation pinnate, triplinerved at base, secondary veins brochidodromous, tertiary veins reticulate; basilaminar and laminar glands absent; petiole 1–3 cm long; basalmost bract often broader, elliptic or ovate, to 2.2 cm wide; bracteoles triangular or narrowly triangular, ca. 1 mm long, glabrous to sparsely pubescent at apex; primary bracteoles sometimes linear-triangular, to 3 mm long. Staminate flowers subsessile or pedicel to 1.6 mm long, glabrous, sometimes appearing long-pedicellate due to slender subtending cyme axis; sepals 5, 1.8–2.8 mm long and wide, outer surface pale green, inner surface purplish pink or pale green with dark pink speckles, glabrous, usually ciliate-margined, thickened at base with membranous margin; outer sepals broadly ovate, obtuse or acute at apex; inner sepals suborbicular, rounded or obtuse at apex; disc annular, 1.8–2.5 mm diam., ca. 0.8 mm high, purplish pink or pale green with dark pink speckles; androecium mushroom-shaped; staminal column ca. 1 mm long, ca. 0.5 mm wide; cap 1.8–2.5 mm diam., 0.9–1.5 mm high, purplish pink or pale green with dark pink speckles, bearing 3 anthers. Pistillate flowers subsessile or pedicel to 0.5 mm long, glabrous; sepals 5, pale yellowish green, glabrous, often ciliate-margined, spreading slightly; outer sepals broadly ovate, 2.0–3.0 mm long, 1.8–2.5 mm wide, obtuse at apex; inner sepals suborbicular, 1.6–3.0 mm long and wide, rounded or obtuse at apex; gynoecium obpyriform, 4–6 mm long, 2.5–3.5 mm wide, green, glabrous; style conical or narrowly conical with rounded apex, 1.5–2.5 mm long, 1.2–1.8 mm wide. Fruit depressed globose, 3-lobed in cross section, 2–2.3 cm long, 2.4–2.8 cm diam. when dry, with slender conical beak at apex, 0.5–1.5 cm long, apparently separating into three mericarps; pericarp ca. 1 mm thick when dry, glabrous; fruiting pedicel 2–5 mm long; infructescence axis 1.5–4 cm long with 1–2 branches ca. 1 cm long. Seeds subglobose, somewhat radially compressed, ca. 1.7 cm long, 1.6–1.8 cm wide, 1.3–1.6 cm thick, ventral and dorsal surfaces convex; testa thin, persistent, whitish or pale brown with vascular bundles visible as slightly darker lines; tegmen brown, ca. 0.5 mm thick, minutely tuberculate.

Older seedlings with enlarged root apex, ca. 3 cm long, ca. 2 cm diam.; leaf blade cordiform, 4–6 cm long, 3–4 cm wide, attenuate at apex, cordate at base, membranous, glabrous with very sparse pubescence at base above, margin entire or repand, venation palmate; basilaminar glands absent or elliptic, ca. 0.3 mm wide, flat-surfaced; laminar glands absent; petiole 1–2.5 cm long, glabrous. Juvenile leaf blade as above except 6–11 cm long, 5–9 cm wide, membranous or chartaceous-membranous, margin repand to irregularly and coarsely crenate-dentate, rarely entire; basilaminar glands elliptic, 0.6–1 mm long, ca. 0.5 mm wide; tooth apices indistinctly glandular or with marginal, suborbicular laminar glands, to 0.4 mm diam.; petiole 2.5–6 cm long.

Distribution and ecology. Endemic to the karst ranges of Ankarana in Réserve Speciale Ankarana and Montagne des Français, located at the northern tip of Madagascar (Fig. 8). A deciduous shrub or

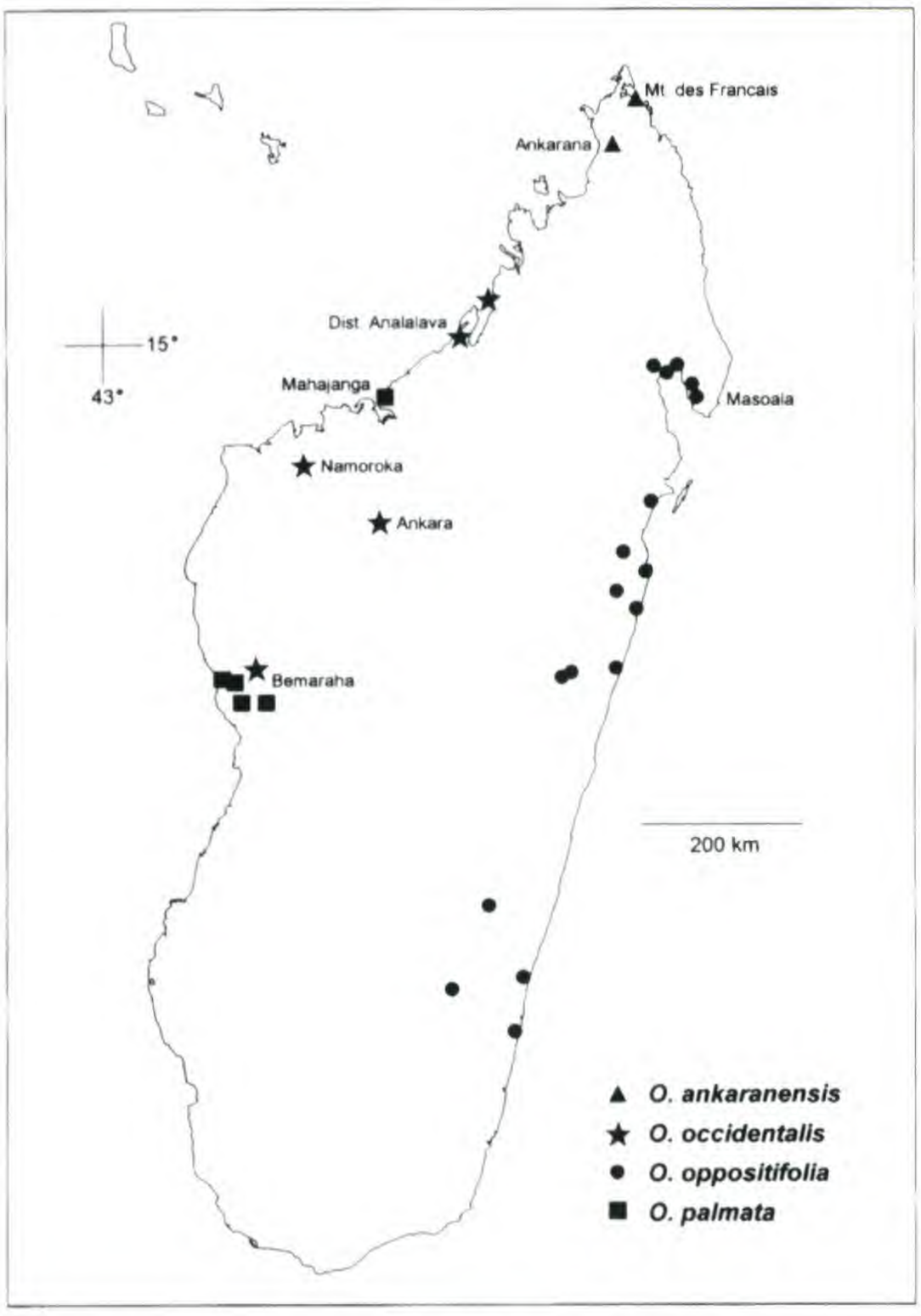

Figure 8. Distribution of *Omphalea* in Madagascar.

small tree found in open dry forest on heavily eroded limestone terrain ("tsingy"). Flowering November through January during the beginning of the wet season.

Local names and uses. None known. Seeds are apparently edible (pers. obs.).

This species is closely related to *Omphalea palmata*, sharing racemose inflorescences with elongate bracts, glabrous flowers and fruit, conical styles, glabrous or glabrescent branches and inflorescence axes, and medium-sized, chartaceous, palmately veined, heart-shaped leaf blades. They differ primarily in inflorescence and bract morphology, pistillate flower pedicel length, and leaf blade pubescence and margin with *O. ankaranensis* having inflorescences not recurved at their base, broader petiolate bracts, shorter pedicels, and glabrous or glabrescent leaf blades with entire or repand to irregularly and coarsely crenate-dentate margins (Figs. 1–4). Mature cymes are lax with conspicuously divaricate axes, each axis terminating in a flower and usually with two subopposite branches (Figs. 1A, 4). These two species together with *O. occidentalis* form a group of dry forest Madagascan species that is very distinct from the single wet forest Madagascan species, *O. oppositifolia*. This species group is characterized by deciduous leaves with heart-shaped or ovate blades, palmate primary venation, weakly to strongly percurrent tertiary venation, and fruit with a conical apical beak.

Intrapopulational variation in the shape of the leaf blade margin was observed in the Réserve Ankarana population. The majority of individuals examined had leaf blades with entire to repand margins and brochidodromous (looped) venation (Fig. 1A). However, several mature individuals were observed with very distinctive irregularly and coarsely crenate-dentate blade margins (Figs. 1C, 3) and mixed brochidodromous-craspedodromous venation with veins often terminating the tooth apices. Juvenile individuals observed had leaves mostly with repand to coarsely crenate-dentate margins, occasionally with entire margins, while seedlings were observed to have primarily entire or repand margined leaf blades.

The species was collected only once from Montagne des Français in 1944. No recent collections are known nor have any individuals been found despite active searches by the author and D. Lees (1990–1991). This accessible limestone range is now mostly covered in heavily disturbed dry forest and thicket suggesting that the species may have been extirpated from the area as a result of habitat degradation.

Paratypes. MADAGASCAR. **Antsiranana:** calcaires du Mur de l'Ankarana, *Capuron, Serv. For. 28716* (P); limestone tsingy near Camp Anglais, Réserve Speciale Ankarana, 7 km SE of Matsaborimanga, 12°54′S, 49°07′E, *Gillespie 4052* (MO, P, TAN, US), *4053* (MO, TAN), *4054* (P, juvenile plant), *4056* (P, TAN, US), *4058* (MO), *4059* (DAV, K, MO, P, TAN), *4060* (DAV, NY), *4061* (US, juvenile plant), *4068* (TAN, MO, seedlings), *4070* (CAN, MO, US), *4078* (CAN, MO, P, TAN, NY), *4081* (P, US), *4082* (MO, K, TAN, juvenile plant), *4086* (K); Montagne des Français, *Homolle 386* (P); Plateau Ankarana, *Vaucoulon 92* (P, fruit only).

2. Omphalea occidentalis Leandri, Bull. Soc. Bot. France 85: 529, Fig. 1.26–30. 1938. TYPE: Madagascar. Prov. Mahajanga: Ambongo, rocailles calcaires de Namoroka, Dec. 1926 (fl), *Perrier 17854* (lectotype, designated here, P; isolectotype, P).

Distribution and ecology. Endemic to the karst ranges or plateaus of Bemaraha, Namoroka, and Ankara (a single collection from the early 1900s) in the central part of western Madagascar (Fig. 8). A deciduous shrub or small tree found in dry forest on limestone outcrops. Flowering September through December, when plants are leafless or with young leafy shoots during the latter half of the dry season to beginning of the wet season. Fruits have been collected in December and January when mature leaves are present during the wet season. An

additional more northerly and somewhat distinct population (*Capuron, Serv. For. 18826*) is found in dry coastal forest (substrate unknown) in Analalava District northwest of Mahajunga (flowering October–November).

Local names and uses. Beravy (*Rakotonao, RN 6408*), Ravintsingy (*Capuron, Serv. For. 18826*). Seeds reported to have a fleshy, white, edible testa (Leandri, protologue).

This species may be easily distinguished from the related dry forest species, *Omphalea ankaranensis* and *O. palmata*, by its larger, more coriaceous leaves, stout branchlets, and dense velvety yellowish pubescence on most plant parts (branchlets, leaves, inflorescence axes, bracts, sepals, gynoecia, and fruit; see below for exceptions). The spicate inflorescences have glomerate cymules, very small, non-foliaceous bracts, and are typically pendent with a strongly recurved base. This is the only species of *Omphalea* that does not have conspicuous foliaceous inflorescence bracts.

Leaf blades of adult plants are mostly entire-margined or sometimes remotely dentate near the apex. In contrast, juvenile plants have leaf blades that vary from repand to coarsely and irregularly crenate-dentate to sometimes distinctly three-lobed. Ontogenetic variation in leaf morphology is characteristic of the majority of species in the genus (Gillespie, 1988b).

Omphalea occidentalis was described from two collections made by Perrier de la Bâthie. *Perrier 17854* is here designated as the lectotype; the two specimens include inflorescences, flowers, and leaves. The three syntype specimens labeled *Perrier 1326* lack a specific date but do contain the information, "Fl. septembre—Fr. janvier." They appear to represent two separate collections, one consisting only of leafless flowering branches presumably collected in September and the other of branches with mature leaves and fruit collected in January.

A collection from dry coastal forest in Analalava District, Mahajunga Province (*Capuron, Serv. For. 18826*), may represent a distinct subspecies or closely related species. Although closely resembling typical *Omphalea occidentalis*, it differs in its erect inflorescences with glabrous to sparsely pubescent axes and bracts, and glabrous fruit. *Decary 14870*, a sterile collection from nearby Ile de Nosy Lava, is tentatively considered to be part of this geograpically isolated northern population. Further collections are needed to clarify the status of these collections.

Additional specimens examined. MADAGASCAR. **Mahajanga:** District Analalava, Canton Antonibe, Forêt d'Ambondro-Ampasy, *Capuron, Serv. For. 18826* (P—2 sheets); Ile de Nosy Lava, *Decary 14870* (P); District Soalala, Namoroka, Réserve Naturelle 8, *Decary 15840* (P); limestone tsingy near Ambodiriana, 9 km E of Antsalova, 18°39′S, 44°43′E, *Gillespie 4133* (MO, TAN, seedlings), *4135* (CAN, seedling), *4138* (MO, TAN); along Antsalova-Ambondro track ca. 3 km E of Ambodiriana, 9 km E of Antsalova, 18°39′S, 44°43′E, *Gillespie 4145* (MO, P, TAN), *4146* (DAV, MO, P, TAN, US), *4147* (MO, P, seedlings); ca. 1.5 km E of Ambodiriana, 9 km E of Antsalova, 18°39′S, 44°43′E, *Gillespie 4148* (CAN, MO, TAN, US, juvenile plants), *4150* (P), *4151* (NY, P, juvenile plant); limestone tsingy forest opening SW of Ambodiriana, 9 km E of Antsalova, 18°39′S, 44°43′E, *Gillespie 4155* (CAN, DAV, K, MO, NY, P, TAN, US), *4156* (US), *4157* (CAN, MO, NY, P, TAN), *4158* (CAN, K, MO, NY, TAN), *4162* (K, MO, juvenile plants), *4163* (MO, US); calcaires de l'Antsingy vers Ambodiriana, E d'Antsalova, *Leandri et al. 2124* (P), *2176* (P); Plateau d'Ankara, *Perrier 1326* (syntypes, P—3 sheets); District Soalala, Canton Amatomavo, Réserve National 8 (Namoroka), *Rakotonao, RN 6408* (P).

3. **Omphalea oppositifolia** (Willdenow) L. J. Gillespie, comb. nov. Basionym: *Hecatea oppositifolia* Willdenow, Sp. Pl. 513. 1805. *Hecatea biglandulosa* Persoon, Syn. Pl. 2: 588. 1807. *Omphalea biglandulosa* (Persoon) Baillon, Étude Euphorb. 528. 1858. *Omphalandria oppositifolia* (Willdenow) Kuntze, Rev. Gen. Pl. 2: 609. 1891. TYPE: Madagascar. "Dans le voisinage de la mer," *Du Petit-Thouars s.n.* (holotype, P; fragment of holotype with original illustration, P; isotype, P).

Hecatea alternifolia Willdenow, Sp. Pl. 514. 1805. *Omphalea alternifolia* (Willdenow) Baillon, Étude Euphorb. 528. 1858. TYPE: Madagascar, *Du Petit-Thouars s.n.* (holotype, P).

Distribution and ecology. Endemic to eastern Madagascar, from the Masoala Peninsula to just south of Farafangana (Fig. 8). An evergreen large shrub to medium-sized (to ca. 30 cm diam.) tree found in lowland to montane wet tropical forest, from near sea level to 1200 m. Flowering (August) September to November (December) in Toamasina sub-prefecture and November to January in Fianarantsoa sub-prefecture. Fruiting specimens have been collected between December and February.

Local names and uses. Fianarantsoa: Hitsebo (Antaifasy dialect), mandrésy, ramoha, varanahy. Toamasina: Malambovony fotsy, salihy, salehy, salejy, tsalehy, voantsalehy, valahakoho, vaolokoa, voalokoho, voalohakoho, voalatakakoho. Province unknown: Huzo-malay.

The species is cultivated on a small scale as a foodplant for rearing *Chrysiridia ripheus* larvae (Lees, pers. comm.). Leaves from wild collected and to a lesser extent cultivated plants provide the main food supply for these commercially raised larvae. Other occasional local uses are as a mediocre quality construction wood (*Serv. For. 12078*) and as a

living fence post (Lees, pers. comm.). Seeds are reported to be edible (*Cours 2534*; *Martin, RN 6667*), with one collector suggesting they are edible after removal of the cotyledons (*Serv. For. 26671*).

This species is distinct from all other Madagascan species in having evergreen leaves with elliptic, obovate, or oblanceolate, pinnately veined blades. Leaf blades are entire-margined and subcoriaceous to coriaceous and often somewhat succulent in texture. Venation is relatively disorganized with secondary veins diverging at a wide, usually variable angle and tertiary venation random-reticulate. The conspicuous pendent inflorescences have white, cream, or greenish white bracts and small whitish flowers that are sometimes tinged with dark pink or red. A unique character is the paired foliaceous whitish bracteoles that resemble bracts in size, shape, and color, in contrast to the typically very small triangular green bracteoles found in most other species of the genus (except *O. mansfeldiana*, which may have enlarged epetiolate bracteoles).

Adult leaf blades are variable in size (6–25 cm long and 3–10 cm wide) and shape within a population and to a lesser extent on an individual, with flowering branches usually bearing smaller leaves than vegetative branches or individuals. Ontogenetic variation in leaf blade shape occurs with juvenile individuals having proportionately narrower leaf blades that are oblanceolate to linear-oblanceolate in shape and usually lobed apically with one to two pairs of rounded to acute lobes.

Willdenow's specific epithet *oppositifolia* appears to be somewhat of a misnomer. The name was apparently based on Du Petit-Thouars's (1804a) inaccurate description of the leaves as opposite or verticillate in threes. Leaves are alternate and never strictly opposite but may sometimes be subopposite or subverticillate, as depicted in Du Petit-Thouars's illustration (1804a: tab. 5; 1804b: tab. 5; 1805: tab. 3).

Although the species has been known throughout most of its history as *Omphalea biglandulosa*, a name change to *O. oppositifolia* is necessary since Willdenow's publication of the species predates that of Persoon by two years. The former name was nomenclaturally superfluous when published, since it was based on the same type as *O. oppositifolia*, a collection by Aubert du Petit-Thouars. Kuntze (1891) recognized this and published the new combination *Omphalandria oppositifolia* in his list of all new combinations associated with Patrick Browne's newly restored genus *Omphalandria*. Pax and Hoffmann (1912, 1931) did not follow Kuntze's lead and retained the name *O. biglandulosa*. Although recognizing that *Hecatea oppositifolia* has priority, Pax and Hoffmann (1912) mentioned that the name had apparently not been cited since the time of Willdenow. Both Willdenow and Persoon appear to have based their new species on Du Petit-Thouars's detailed description and illustration (1804a: tab. 5) of the first species under his new genus *Hecatea*. Du Petit-Thouars did not provide specific epithets for either this species or for a second related species.

Willdenow named a second species in the genus *Hecetea*, *H. alternifolia*, and distinguished it from *H. oppositifolia* on the basis of its alternate, much larger leaves (i.e., much larger than 11 cm long and 4 cm wide), and racemose inflorescences. This diagnosis was based on a brief description by Du Petit-Thouars (1804a) of a second species in his new genus *Hecatea*, which he promised to describe in a later publication but never did. Though recognized by Baillon (1858), this species was reduced to synonymy under *O. biglandulosa* (= *O. oppositifolia*) by Mueller (1866) who correctly recognized that in the latter species leaf size and shape vary considerably, inflorescence structure varies both among individuals and ontogenetically, and the leaves are never strictly opposite but rather alternate with a tendency to be clustered and appearing subopposite, particularly just below the terminal inflorescence.

Recent collectors have remarked on what appear to be two different forms of the species occurring in separate populations in the Masoala Peninsula and neighboring Makira region. One form is a gracile understory shrub, to 3 m tall, with slender racemose or few-branched paniculate inflorescences and pale green or greenish white bracts. Flowers are pale green or greenish white in bud, the staminate flower sepals becoming dark reddish at anthesis. The other more common typical form is a small to medium-sized tree, often densely branched and foliose, with more branched inflorescences, and cream-white bracts and flowers. The status of these two forms, whether ecological variants or otherwise, needs to be further investigated in the field.

Selected specimens examined. MADAGASCAR. **Fianarantsoa:** environs d'Ivohibe, *Armand 60* (P); Andrambovato, à l'est de Fianarantsoa, *Capuron, Serv. For. 11592* (P); forêt à l'est d'Ivohibe, *Humbert 3162* (P); Andrambovato, à l'est de Fianarantsoa, *Humbert & Capuron 28507* (P); district Farafangana, canton Thorombe, forêts à l'ouest immédiat de Manombo, *Ratoimbazafy 353* (P); Manombo, Thorombe, *Serv. For. 9485* (P). **Toamasina:** Fanovana, "Andevorante Prov.," 24 Oct. 1912, *Afzelius s.n.* (S); Forêt de l'Analamazaotra, Dec. 1905, *Alleizeite s.n.* (L); Tamatane, near the capital, *Baron 6011* (K, P); Ambila Lemaitso, *Capuron, Serv. For. 8570* (P); Réserve

Naturelle 1 (Betampona), Dist. Tamatave, *Capuron, Serv. For. 8578* (P); Massif d'Andriandavibe, près d'Anevoka, à l'est de Périnet, *Capuron, Serv. For. 24161* (P); Canton Vavatenina, Ambalahady, *Cours 1541* (P); Réserve 1, Betampona, poste Rendrisandry, sommet de Vohimarangitre, *Cours 2534* (P); itinéraire de Didy à Brickaville, *Cours 4779, 4788, 4797, 4828* (P); 8 km ESE of Périnet (= Andasibo), 18°57′S, 48°30′E, *Gillespie 4000* (CAN, K, MO, P, TAN), *4002* (MO, P, juvenile plant), *4003* (MO, US); 6 km ESE of Périnet (= Andasibo), along Anevoka River, 18°57′S, 48°28′E, *Gillespie 4005* (NY, juvenile plant), *4007* (MO, P, TAN, US), *4009* (P), *4010* (TAN), *4014* (CAN, MO, NY, P, TAN), *4016* (K, MO), *4017* (MO, TAN), *4018* (P, juvenile plant), *4019* (K, juvenile plant), *4020* (CAN, juvenile plant), *4021* (MO, juvenile plant), *4022* (MO, US, juvenile plant), *4030* (K, NY, TAN), *4031* (DAV, MO, P, TAN, US), *4032* (CAN, MO, TAN); Andriandavibe, 6 km ESE of Périnet (= Andasibo), 18°57′S, 48°28′E, *Gillespie 4023* (MO), *4028* (DAV, K, TAN, US), *4029* (CAN, MO, NY, P, TAN); Foulepointe, *Humblot s.n.* (P); coast to capital, *Kitching s.n.* (K); Réserve National 1, Tamatave, *Martin, RN 6667, RN 6677* (P); Baie d'Antongil, *Perrier 8682* (P); 160 Route de Tamatave, *Rajeridrison s.n.* (P); Fanovana, *Rakatozafy 407* (P, TAN); Nosy Mangabe, an island in the Bay of Antongil, 5 km S of Maroantsetra, 15°30′S, 49°46′E, *Schatz 2771* (MO, P); Masoala Peninsula, ca. 3 km NE of Antalavia, along Antalavia River, 15°47′S, 50°02′E, *Schatz et al. 2791* (MO); Nosy Mangabe, an island in the Bay of Antongil, 5 km S of Maroantsetra, 15°30′S, 49°46′E, *Schatz & Carlson 2958* (MO); Farankaraina, near Andranofotsy, District Maroantsetra, *Serv. For. 12078* (P); Canton Périnet, Nanda, near Ambalovola, *Serv. For. 26671* (P); Forêt d'Analamazoatra, Nov. 1888, *de Viders s.n.* (P). Without precise locality: *Chapelier s.n.* (P); Sep., *Perrot s.n.* (P); *Herb. Poivre* (P).

4. **Omphalea palmata** Leandri, Bull. Soc. Bot. France 85: 530, Fig. 1.22–25. 1938. TYPE: Madagascar. Prov. Mahajanga: "bas bassin du Manambolo," Oct. (fl), *Perrier 9849* (lectotype, designated here, P; isolectotypes, P—3 sheets). Figures 5–7.

Distribution and ecology. Endemic to Réserve Naturelle Bemaraha west to the coast and to the vicinity of Mahajanga along the central west coast of Madagascar (Fig. 8). A deciduous few-branched shrub or small tree found in dry forest on sandy soils and on eroded limestone terrain. Flowering July through October while plants are leafless during the dry season; young vegetative shoots produced sympodially at the inflorescence base may be present during the latter part of the flowering season. Fruiting collections have been made in October and December while plants are in leaf (October collections have only young leaves present). Larvae of the Sunset Moth (*C. ripheus*) were found feeding on foliage and fruit (Lees & Gillespie, pers. obs.); herbivory damage was moderately heavy in the population sampled.

Local names and uses. Sarihasy (*Léandri 469*). Seeds have a pleasant flavor and are reported to be very oily (*Perrier 16809*; pers. obs.).

The species differs from the closely related *Omphalea ankaranensis* by its frequently deeply lobed leaf blades (Fig. 7), extreme variation in blade shape from entire to very deeply palmately lobed (Figs. 6, 7), linear or narrowly oblong, epetiolate inflorescence bracts, condensed cymes, longer pistillate flower pedicels, and inflorescences that are strongly recurved at the base. Although overlapping in distribution and habitat with *O. occidentalis*, the species may be easily recognized by its smaller (less than 16 cm long), chartaceous, often lobed leaf blades, racemose inflorescences, and bracts to 8 cm long.

The most distinguishing feature of *Omphalea palmata* is the leaf blade shape and its high degree of variation, from entire to very deeply palmately lobed (Figs. 6, 7). Deeply lobed leaves have primary lobes constricted basally, acute or acuminate apically, with each lobe itself often pinnately lobed with one to several pairs of small usually asymmetrical lateral lobes and a larger acuminate terminal lobe (Fig. 7). The lowermost leaves on a branch may occasionally be coarsely crenate-dentate either apically or along the entire margin (similar to *O. ankaranensis*). *Omphalea trichotoma* Mueller Argoviensis, a species of dry thicket on limestone terrace in Cuba, is also characterized by variably lobed adult leaf blades, from entire to very deeply palmately lobed; however, these differ considerably in shape, having linear-oblong lobes not constricted basally and with blunt apices.

In the protologue Perrier described the leaves as initially entire, becoming very deeply lobed. Indeed, the type collection with fruit made in December (*Perrier 16809*) has very deeply lobed mature leaves, while all new shoots bear young, very small, entire leaves. However, the two type collections made in October (*Leandri 469, Perrier 9849*) have new shoots that bear only immature, very deeply lobed leaves. In the population examined by the author in detail (vicinity of Antseranandraka, *Gillespie 4167–72, 4178–79*) leaf blade shape varied from entire to deeply lobed on a single individual. The degree of lobing varied considerably among individuals with some having predominantly one leaf shape, such as shallowly lobed, and others having a much greater range from entire to deeply lobed. Ontogenetic or positional factors did not appear to influence degree of lobing.

Leandri designated two collections, *Perrier 9849* and *Perrier 16809*, as syntypes (*Leandri 469* is a paratype). Only *Perrier 9849* includes flowering

material; the specimen with fruit, in addition to inflorescences and leaves, is selected as lectotype.

Additional specimens examined. MADAGASCAR. **Mahajanga:** dunes à Ampazony, au N de Majunga, *Capuron, Serv. For. 18528* (P); 1–3 km SW of Antseranandraka, along road to Ambereng between Lakes Bemamba and Masama, ca. 30 km SW of Antsalova, 18°50′S, 44°24′E, *Gillespie 4167* (CAN, MO, P, TAN, US), *4168* (P, US), *4169* (CAN, MO, P, TAN, US, older seedlings), *4170* (CAN, NY, TAN), *4171* (MO, P, TAN), *4172* (MO, P, TAN, juvenile plants), *4178* (MO, NY), *4179* (DAV, K, TAN); Trangahy, bas bassin du Manambolo, *Leandri 469* (paratypes, P—2 sheets); Forêt de Tsiampihy et forêts cotieres près de Besaraha de Bemiha et de Soahanina, *Leandri et al. 2264* (P); near Majunga, *Perrier 16809* (syntypes, P—2 sheets); forest between Ambereng and Lac Masama, SW of Antsalova, 18°51′S, 44°27′E, *Phillipson 2266* (DAV, K, MO, P, TAN); Réserve Naturelle 9 (Bemaraha), Bekobaka, *Rakotozafy 1012* (TAN).

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New Species of *Aristea* (Iridaceae) from South Africa and Notes on the Taxonomy and Pollination Biology of Section *Pseudaristea*

Peter Goldblatt

B. A. Krukoff Curator of African Botany, Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

John C. Manning

National Botanical Institute, P. Bag X7, Claremont 7735, South Africa

ABSTRACT. *Aristea teretifolia* and *A. cantharophila* are new species from the winter-rainfall region of southern Africa. Both belong in section *Pseudaristea*, one of eight sections of this genus of ca. 52 species of sub-Saharan Africa and Madagascar. *Aristea teretifolia* has pink, mauve, or cream flowers, the inner tepals of which are longer than the outer and have a large dark blotch near the base, and stands out in the section in its very narrow linear or sometimes terete leaves. *Aristea cantharophila* has narrow, linear to sword-shaped leaves fairly typical of the section, and mauve or white flowers with subequal tepals, each of which has a zone of dark color near the base. In their long pedicels, oblong-trigonous ovary, large and deeply fringed stigma lobes, and woody, elongate, tardily dehiscent capsules these new species conform closely to the characteristic features of section *Pseudaristea*. Field observation suggests that both species are adapted for pollination by monkey beetles (Scarabidae: Rutelinae), which use the flowers of these and at least one other species of the section as sites for feeding and mating. The dark markings on the tepals appear to mimic beetles and presumably encourage visits by these insects.

The Afro-Madagascan genus *Aristea* comprises some 52 species (Weimarck, 1940; Goldblatt, 1991, 1995a, b) currently divided among eight sections. As redefined by Goldblatt (1995a), section *Pseudaristea* Pax comprises five species, all of Western Cape Province, South Africa, a region of winter rainfall and summer drought. To this number we add two new species, *A. cantharophila* (Fig. 1A) and *A. teretifolia* (Fig. 1B), and exclude *A. zeyheri* Baker from the section. The new species are both narrow endemics of lowland sites in the southwestern part of Western Cape Province. They share all the characters that define the section and differ mainly in their unusually colored and marked flowers (Fig. 1), and in the case of *A. teretifolia* also in its terete or extremely narrow leaves. The defining features of section *Pseudaristea* are flowers with long pedicels, an oblong and three-lobed to three-angled ovary, large inflorescence spathes concealing the flower buds, prominent and deeply fringed stigma lobes, and woody, elongate, tardily dehiscent, deeply three-lobed capsules. To this list of morphological features can be added di-zonosulculate pollen grains, unique in Iridaceae (Radelescu, 1970; Schulze, 1971; Le Thomas et al., 1996), and exine with reticulate sculpturing.

Relationships of *Aristea zeyheri*

Aristea zeyheri was assumed by Weimarck (1940) to accord in most of its features with those that define section *Pseudaristea.* New material collected since Weimarck completed his monograph of the genus in 1940, however, shows that this species has capsules with three prominent, narrow wings, 2–4 flattened, plate-like seeds per locule, and minutely trifid styles. These are exactly the apomorphic features that define section *Racemosae.* It seems likely that *A. zeyheri* is most closely related to *A. racemosa* Baker of that section, which it resembles closely in overall morphology, particularly the slender habit and subterete leaves. The pollen grains of *A. zeyheri* are monosulcate, or in one population zonosulculate (unpublished), with rugulose exine. In its exine sculpturing and basic aperture condition, *A. zeyheri* also accords with section *Racemosae*, species of which have pollen grains with monosulcate apertures and either microreticulate or rugulose exine (Goldblatt & Le Thomas, in prep.).

Pollination Biology of Section *Pseudaristea*

Most species of *Aristea* have deep blue flowers, bright yellow anthers and pollen, and lack conspicuous dark markings. Preliminary observations on the pollination of the genus indicate that the blue-flowered species of *Aristea* are pollinated by a va-

riety of bees foraging for pollen. These include: *Apis mellifera* (Apidae) and three species of small bees in the family Halictidae on *A. macrocarpa* G. Lewis; *Xylocopa caffra* and *X. rufitarsus* (Anthophoridae) on *A. major* Goldblatt; *Anthophora diversipes* (Anthophoridae) on *A. inaequalis* Goldblatt & Manning; and *Zonalictus* sp. (Halictidae) and a species of Andrenidae on *A. pauciflora* Wolley Dod. Pollination biology of the two new species of section *Pseudaristea* contrasts sharply with this pattern. Both appear to be pollinated exclusively by monkey beetles (Scarabidae: Rutilinae: Hopliinae). Observations at the type localities of *Aristea cantharophila* and *A. teretifolia* indicate that species of the large beetles, *Anisonyx ursus* and/or *Lepithrix pseudoplebeia*, respectively, use the flowers as sites for feeding on pollen and mating (Goldblatt & Manning, 1996). The furry insects usually become densely covered with pollen during visits to the flowers but their activity appears to cause little damage to the flowers except for some loss of pollen. Because of their erratic movements they brush against the broad stigma lobes and in so doing transfer pollen from their bodies to the receptive parts of the stigmas.

Our field studies indicate that another species of section *Pseudaristea*, *A. lugens* (L.f.) Ker Gawler, is also adapted for pollination by monkey beetles. The flowers of this species are visited by numerous individuals of two monkey beetle species, *Anisonyx longipes* and *A. ursus*, which behave in the same way as those visiting *A. cantharophila* and *A. teretifolia* (Goldblatt & Manning, 1996). *Aristea lugens* is unusual in the genus in having large pale-colored flowers, the smaller outer tepals of which are dark blue-black in the upper two-thirds (Fig. 1C). The common features of the beetle-pollinated species of *Aristea* are thus a large, pale-colored flower with dark markings on the outer, or all of the tepals. The phenology of these beetle-pollinated species differs from the norm for the genus. The flowers open relatively late in the morning and last well into the afternoon. The pale color of the flowers of these beetle-pollinated species may serve to enhance the dark markings, which in turn may mimic the bodies of beetles and thus encourage visits by these insects. A flower with strongly contrasting dark markings is a frequent feature of monkey-beetle-pollinated flowers (Goldblatt & Manning, 1996; Steiner, 1997) and appears to be the hallmark of this pollination system in *Aristea*.

Two other species of section *Pseudaristea* have unusually colored and marked flowers for the genus. *Aristea biflora* Weimarck has large lilac or pale blue flowers, the outer tepals of which each have a pair of round, transparent windows near the base (Fig. 1D). These appear dark against the dark green ground cover when viewed from above, and may serve the same function as the dark markings on the flowers of *A. cantharophila*, *A. lugens*, and *A. teretifolia*. The pollination biology of *A. biflora* is unknown. A second species, *A. spiralis* (L.f.) Ker Gawler, has pale bluish or white flowers that face to the side, unusually long filaments, 14–18 mm long, and anthers 6–7 mm long. It is the only species of the genus that produces nectar, a small quantity of which is secreted from perigonal nectaries at the base of the tepals (Manning, unpublished). The species may be adapted for pollination by the long-tongued fly, *Philoliche rostrata* (Tabanidae) (Johnson, 1992; Johnson, pers. comm.). Although we have also seen this fly foraging for nectar on *A. spiralis*, bees, too (Halictidae species), have been recorded collecting pollen from the flowers and in so doing accomplishing pollen transfer (I. Nänni, pers. comm.). Plants from the mountains near Wemmershoek and Franschhoek (e.g., *Barker 4147*, *Wasserfall 532*) that have the broadly two-winged stems and large flowers typical of *A. spiralis* have short stamens with filaments 8–10 mm long and anthers ca. 4 mm long, and may represent yet another species of section *Pseudaristea*. This section thus contains the only species that are known to deviate in their pollination biology from the norm in the genus. In addition, the pollination systems involved are clearly uncommon and are well developed only in the winter-rainfall region of southern Africa.

New Species

1. **Aristea cantharophila** Goldblatt & Manning, sp. nov. TYPE: South Africa. Western Cape: foot of Sir Lowry's Pass, 1 Sep. 1995, *P. Goldblatt & Manning 10284* (holotype, NBG; isotypes, K, MO). Figure 1A.

Plantae 18–30 cm altae, caulibus leviter compressis erectis usitate eramosis, foliis linearibus ad anguste ensiformibus (2–)3–4 mm latis, inflorescentibus rhipidiis binatis 2–4-florum, spathis 20–28 mm longis, attenuatis, bracteis ca. 10 mm longis, floribus pedicellatis 8–10 mm longis, lilacinis ad malvinis vel albens, tepalis atrocoloribus infra patentibus, exterioribus obovatis 22–26 × 12–14 mm, interioribus ovatis, 24–26 × 14–15 mm, filamentis ascendentibus ca. 5 mm longis atrocaeruleo-nigris, antheris ca. 5.5 mm longis, ovario cylindrico-trigono 15–18 mm longis, stylo 12–15 mm longo, lobis stigmatarum fimbriatis ca. 1.6 mm longis, capsulis cylindrico-trilobatis (25–)30–50(–60) mm longis.

Plants 18–30 cm high, forming tussocks up to 12 cm diam. *Stems* erect, lightly compressed and

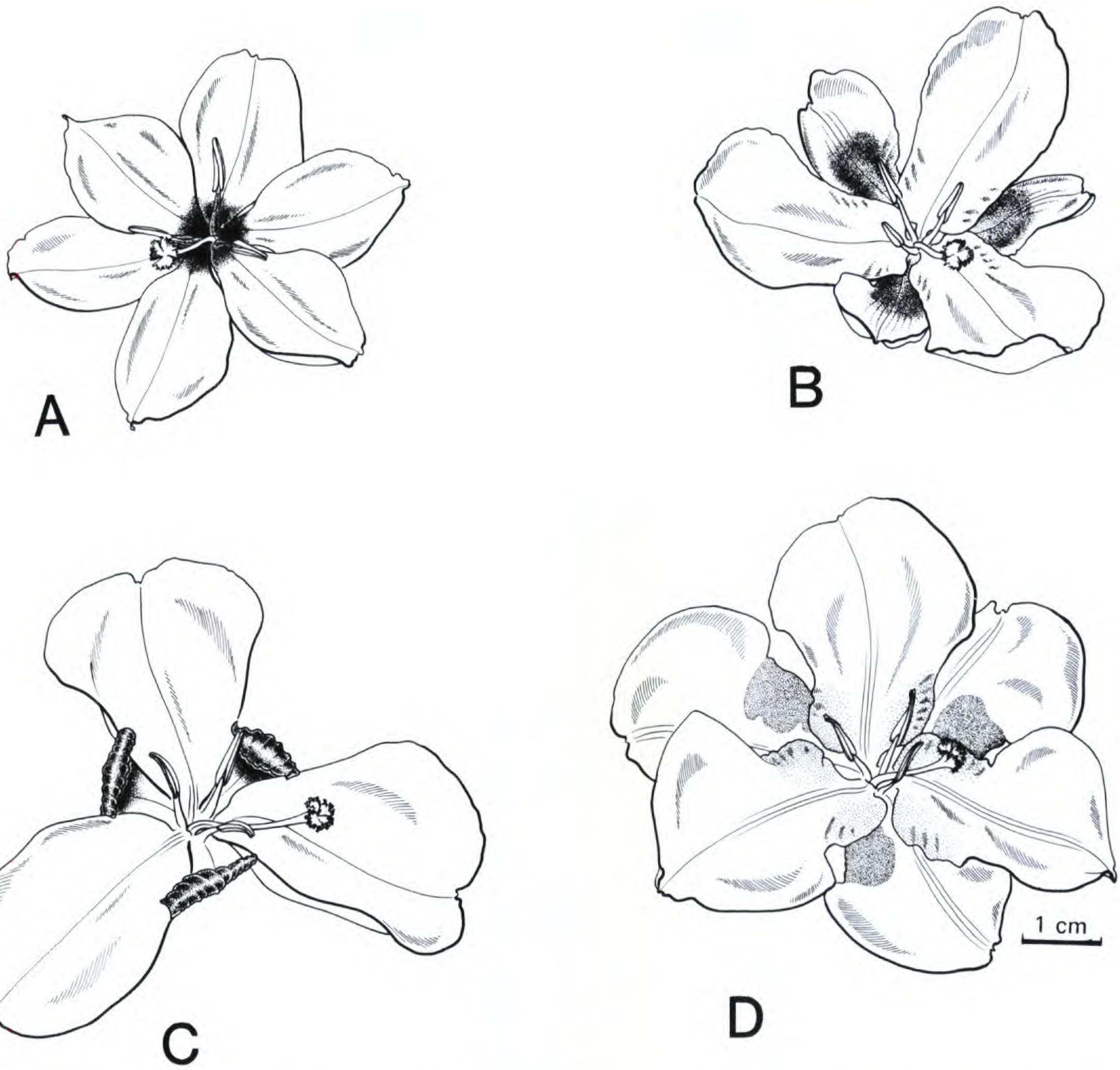

Figure 1. Flowers of species of *Aristea* sect. *Pseudaristea* (tepals curve upward and may appear smaller than scale). —A. *Aristea cantharophila.* —B. *Aristea teretifolia.* —C. *Aristea lugens.* —D. *Aristea biflora.* Drawn by J. Manning.

broadly elliptic in section, usually bearing a single largely sheathing leaf in the midline, unbranched or the lowermost inflorescence on a short, rather slender branch borne in the axil of the cauline leaf, the remaining one or two inflorescences sessile. *Leaves* in a basal fan, narrowly sword-shaped to nearly linear, (2–)3–4 mm wide, loosely twisted, reaching to about the middle of the stem. *Inflorescences* binate rhipidia, one to three, the lateral binate rhipidia sessile or sometimes on a short slender branch, 2- to 4-flowered, the individual rhipidia thus 1- or 2-flowered, the lateral binate rhipidia sometimes 1-flowered; *rhipidial spathes* 20–28 mm long, attenuate, green below, becoming dry and light brown from the apex, the margins light brown with translucent edges; *floral bracts* ca. 10 mm long, membranous and ± transparent. *Flowers* borne on pedicels 8–10 mm long, actinomorphic with the style eccentric, pale lilac, mauve, or whitish with a dark greenish black central eye 6–7 mm diam. fading to turquoise at edges, the reverse of the outer tepals greenish along the midlines and the right halves flushed a biscuit color, opening ca. 9 A.M. and lasting until the late afternoon the same day; *tepals* barely connate at the base for ca. 1.5 mm, the outer tepals obovate, 22–26 × 12–14 mm, fully patent or dipping slightly below horizontal, inner tepals broadly ovate, narrow at the base, fully patent or dipping below the horizontal, 24–26 × 14–15 mm. *Filaments* ascending, straight, adnate to the outer tepal bases, ca. 5 mm long, dark blue-black; *anthers* basifixed, ca. 5.5 mm long, pale yellow, the pollen orange, grains dizonasulculate, the exine reticulate. *Ovary* cylindric-trigonous, curving outward, 15–18 mm long, rapidly elongating after fertilization, style 12–15 mm long, dividing into

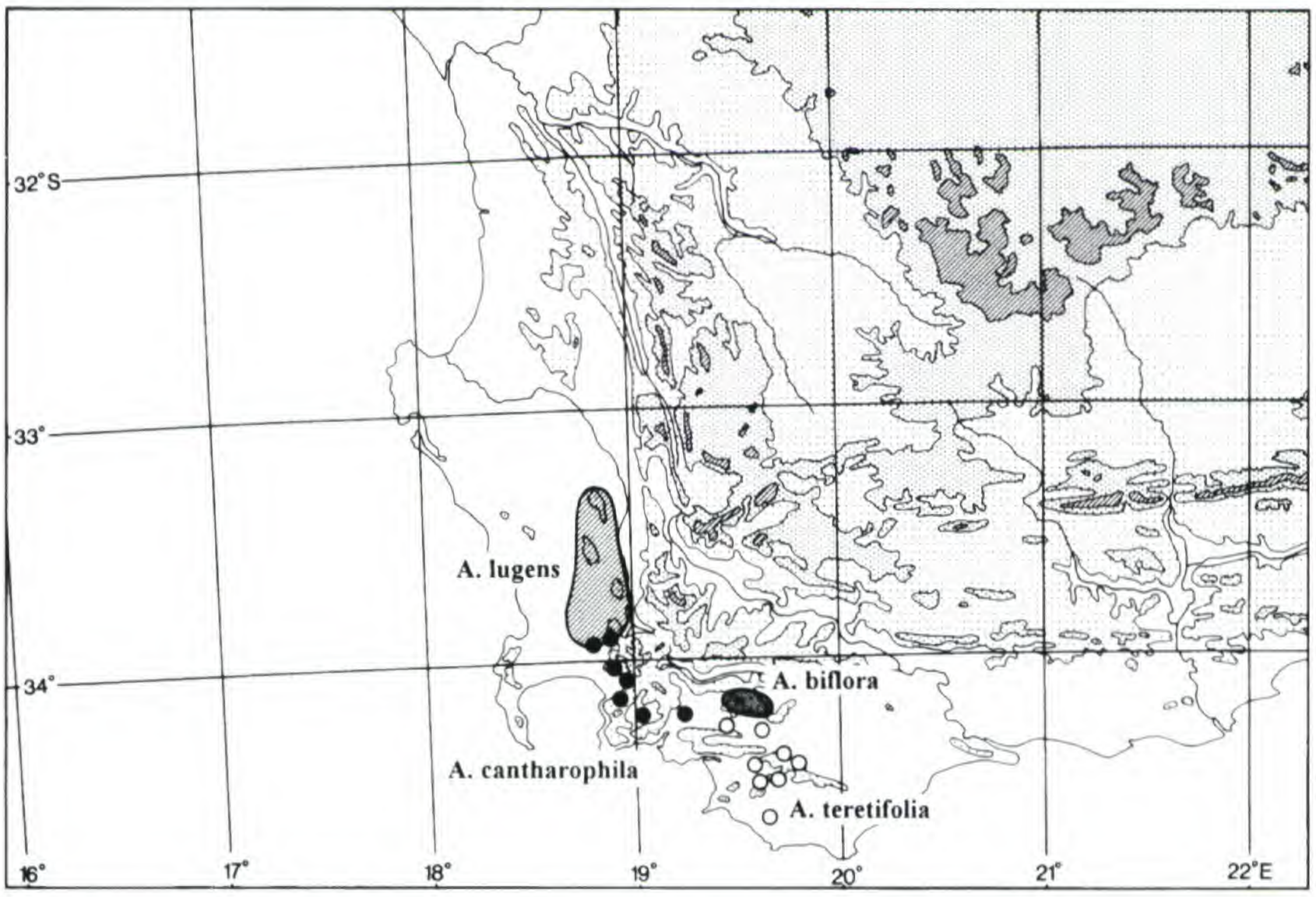

Figure 2. Map of the southwestern part of Western Cape Province, South Africa, showing the ranges of *Aristea lugens*, *A. cantharophila*, *A. teretifolia*, and *A. biflora*.

three short, broad, fimbriate lobes ca. 1.6 mm long, dark blue-black below, fading above, the stigma lobes dark blue. *Capsules* cylindric, deeply 3-lobed in transverse section, (25–)30–50(–60) mm long; *seeds* numerous per locule, shortly cylindric, the base and apex obliquely truncate.

Flowering late August to mid September.

In the spring of 1995, after a fire the previous summer on the lower slopes of the Hottentots Holland Mountains near Sir Lowry's Pass, we encountered a small population of an unknown species of *Aristea* flowering profusely. The plants, here described as *A. cantharophila*, were unusual in the genus in having white or mauve to lilac flowers and apparently unique in their dark greenish black (when flowers white) or dark purple (when mauve or lilac) central eye. Matching the dark eye, the filaments are a similar dark color, while the anthers contrast starkly with the rest of the flower in their orange color. Clearly a member of section *Pseudaristea*, *A. cantharophila* has sessile lateral inflorescences, long-stalked flowers with a cylindric ovary, and elongate capsules, deeply 3-lobed in section. The capsules are usually 50–60 mm long, exceptionally to 75 mm long. This is longer than recorded for any other species of the section or of the genus.

The relationships of *Aristea cantharophila* appear to be with *A. pauciflora* and *A. simplex* Weimarck. These relatively unspecialized members of section *Pseudaristea* have uniformly blue flowers that, like those of *A. cantharophila*, last a single day each. Flowers of *A. pauciflora* open shortly after sunrise and fade early in the afternoon unlike those of *A. cantharophila*, which open at about 9 A.M. and fade late in the afternoon. Floral phenology of *A. simplex* is unknown. Apart from the distinctive coloring of the tepals, filaments, and anthers of *A. cantharophila* there are no major differences among the three species. *Aristea cantharophila* appears to have particularly long capsules and is the smallest plant of the three, mostly about 20 cm high, occasionally to 30 cm. The dark blue-flowered and more robust *A. pauciflora* stands 35 to 60 cm high and has flowers with subequal tepals 15–18 mm long. It can be distinguished in addition by having the locules of the ovary and capsule angular rather than rounded. *Aristea simplex* has pale blue flowers with an unusual secund orientation, and is 30–50 cm high. Detection of other differences, if any, between the species awaits critical examination of living plants.

Aristea cantharophila is known only from the lower slopes of the Hottentots Holland Mountains between Sir Lowry's Pass and Somerset West, the low hills to the west near Kuils River and in the rolling clay hills near Bot River in the east (Fig. 2). It was apparently first recorded by Francis Guthrie near Grabouw in 1896 and referred then to *A. pusilla* (Thunberg) Ker Gawler. Specimens from Vergelegen, Somerset West, brought to the Compton Herbarium, Kirstenbosch Botanic Gar-

dens, by K. C. Johnson in 1959 were associated with *A. biflora* by G. J. Lewis, the late specialist of Iridaceae. Plants were later found by E. G. H. Oliver (*Oliver 4320, 4341*) growing among typical *A. lugens* near Kuils River in 1973 after a fire there. Oliver (1973) suggested that the plants he found were a purple-flowered variant of *A. lugens*, although without darkly marked outer tepals. At the Sir Lowry's Pass site plants appeared to be restricted locally to areas of coarse, granite-derived soil, and grew in a fynbos community dominated by *Protea repens* L. (Proteaceae). Plants recorded by Oliver likewise grew in granitic soil but in transitional renosterveld-fynbos with *Eriocephalus africanus* L. (Asteraceae), one of the most conspicuous and characteristic of the woody members of the community.

The pollination biology of *Aristea cantharophila* is unusual for the genus. It appears to be a member of a guild of species with similarly colored flowers, usually with dark centers, and brightly colored, reddish or orange anthers and pollen that are pollinated by monkey beetles (Scarabidae: Rutelinae: Hopliini). At the Sir Lowry's Pass site we observed a single species of beetle, *Lepithrix* sp., actively visiting and pollinating flowers of *A. cantharophila*. These beetles were also visiting and pollinating two species of *Drosera* (Droseraceae) (*D. cistiflora* L. and *D. pauciflora* Banks ex DC.) with virtually identical flowers, either whitish or lilac with dark centers and orange pollen, thus closely resembling the flowers of *A. cantharophila*. They were also visiting *Moraea* cf. *lurida* Ker Gawler (Iridaceae), which at this site has cream-colored flowers, the outer tepals with yellow nectar guides, the claws of the inner tepals and sometimes the upper surfaces of the style branches dark gray, and reddish pollen. The beetles appeared to be primarily feeding on pollen and damaged the flowers minimally. In clambering over the flowers they were visibly covered in the distinctive orange pollen of these species. The beetles' visits to individual flowers lasted at least several minutes, sometimes over an hour, and flowers sometimes had two or three beetles visiting at one time, the individuals feeding or mating in the course of these visits. The beetles appeared to be flower-constant in their foraging. For up to an hour individuals were noted flying from one plant to another of any of the above plants before we lost sight of them. Individuals were also seen leaving flowers of one species to visit another. *Aristea cantharophila* is thus a member of a guild of unrelated plant species with similarly colored flowers that compete for the attention of these beetles, which our observations suggest are their sole pollinator. In the course of observations lasting two hours on two separate days and one hour on two more, we noted only one other potential pollinator visiting any of these species, two individuals of a single fly of the family Muscidae, although other large bees (*Apis mellifera*, *Anthophora diversipes*), butterflies (*Cynthia cardui*), and a variety of flies were active during this period and were visiting other species at the site. The floral phenology of *A. cantharophila* reflects its pollination biology. Flowers open soon after 9 A.M. and fade in the late afternoon, ca. 3:30 P.M., a period when beetles are most active. Flowers of bee-pollinated species of *Aristea* open early in the morning and fade shortly after midday. Bee activity is typically high early in the day, beginning soon after sunrise.

Paratypes. SOUTH AFRICA. **Western Cape:** 3318 (Cape Town) Banhoek, ex hort. Martley (DD), 14 Sep. 1933, *Martley s.n.* (BOL 21919); Kuils River, Langverwacht, Sep. 1973, *Oliver 4320* (STE), *Oliver 4341* (STE). 3418 (Simonstown) Somerset West, Vergelegen (BB), Sep. 1959, *Johnson s.n.* (NBG). 3419 (Caledon) Palmiet River Mts. near Elgin (AC), 9 Oct. 1896, *Guthrie 4263* (NBG); Somerset Sneeukop to Dwarsberg, Sep. 1946, *Stokoe s.n.* (SAM 58751); Caledon–Villiersdorp road (AA–AB), 18 Sep. 1932, *Barnard s.n.* (BOL 21920).

2. Aristea teretifolia Goldblatt & Manning, sp. nov. TYPE: South Africa. Western Cape: Bredasdorp District, Fairfield Estate, 25 Aug. 1994, *I. Nänni 48* (holotype, NBG). Figure 1B.

Plantae 20–30 cm altae, foliis teretibus vel linearibus 1–2 mm latis, caulibus leviter compressis erectis usitate eramosis, inflorescentibus rhipidiis binatis (1–)2–4-florum, spathis 15–18 mm longis, attenuatis, bracteis 10–12 mm longis, floribus pedicellatis 8–10 mm longis, lilacinis vel malvinis vel cremeis, tepalis exterioribus atrobrunneis notatis in dimidio infra, patentibus obovatis asymmetricis ca. 20 × 12 mm, interioribus panduriformibus, 24–28 × 15–17 mm, filamentis ascendentibus ca. 6.5 mm longis albis, antheris ca. 4.5 mm longis, ovario cylindrico-trigono 12–15 mm longis, stylo 9–10 mm longo, lobis stigmatibus fimbriatis ca. 1.3 mm longis, capsulis cylindrico-trilobatibus 20–30 mm longis.

Plants 20–30 cm high, forming small tufts up to 8 cm diam. *Stems* erect, slightly compressed and broadly oval in section, usually bearing a single largely sheathing leaf in the midline, unbranched or the lowermost inflorescence on a short, slender branch, the remaining one or two inflorescences sessile. *Leaves* terete and ca. 1 mm diam. or linear and plane, then 1–2 mm wide, in a basal tuft, reaching at least to the middle of the stem and sometimes shortly exceeding the flowers. *Inflorescences* binate rhipidia, those except the terminal sessile, rarely the lowermost on a short slender branch, 2- to 4-flowered, the individual rhipidia

thus 1- or 2-flowered, the lateral binate rhipidia sometimes 1-flowered; *rhipidial spathes* 15–18 mm long, attenuate, green below, dry and blackish above, becoming dry from the apex, the margins obscurely translucent; *floral bracts* 10–12 mm long, similar to the rhipidial spathes except in size. *Flowers* borne on pedicels 8–10 mm long, actinomorphic with the style eccentric, pale lilac, mauve or cream, occasionally pale yellow, the outer tepals bronze-brown to brownish orange in the lower half, the dark brown color edged in blackish color distally fading to blue or turquoise, on the reverse the midline greenish, the inner tepals each with a white deltoid mark 5–7 mm long at the base and the lower margins translucent for ca. 1 mm wide, lasting two days and fading late on the second day or early on the third day after opening; *tepals* connate at the base for ca. 2 mm, the outer tepals obovate, ca. 20 × 12 mm, asymmetric about the midline with the right half wider than the left, ascending and slightly twisted, inner tepals slightly pandurate, narrow at the base, dipping below the horizontal, 24–28 × 15–17 mm, widest in the upper third. *Filaments* ascending, straight, adnate to the outer tepal bases, ca. 6.5 mm long, white; *anthers* basifixed and versatile, ca. 4.5 mm long, pale yellow, the pollen deep yellow-orange, the grains dizonasulculate, the exine reticulate. *Ovary* cylindric-trigonous, slightly curved, 12–15 mm long, rapidly elongating after fertilization, style 9–10 mm long, dividing into three short, broad, fimbriate lobes ca. 1.3 mm long, white, the fringes of the lobes purple. *Capsules* cylindric, 3-lobed in transverse section, 20–30 mm long; *seeds* numerous per locule, shortly cylindric, the base and apex truncate.

Flowering mid August to mid September.

Collections of a terete-leafed species of *Aristea* from the Bredasdorp District of the southwestern Cape, South Africa, have been available since at least 1895 when plants were recorded by Francis Guthrie in the hills near Elim. Until now this plant has elicited little botanical attention and the few collections in herbaria were assigned to *A. biflora* by Weimarck (1940) or to *A. lugens* in herbaria. Both these species were imperfectly understood by Weimarck, who monographed *Aristea* at a time when the range of specimens available to him was mostly rather poorly preserved. Although *A. lugens* was known from a fine illustration published in *Curtis's Botanical Magazine* (Ker Gawler, 1810) little was known about the distribution ranges and patterns of morphological variation of either *A. lugens* or *A. biflora*, and the details of their floral coloring and marking could not easily be determined from dried material. Both species are now fairly well known and it is clear that *A. teretifolia* is a separate species with its own series of morphological attributes, and that it is isolated geographically from both.

The elongated, deeply three-lobed capsules with almost woody walls and cylindric seeds with obliquely truncate ends place *Aristea teretifolia* in section *Pseudaristea*. It stands out in the section both in its leaf morphology and its flowers (Fig. 1B). The leaves of most collections are terete and ca. 1 mm in diameter. One collection, *Taylor 3746*, from west of Rietpoel and two others from Shaw's Pass (*Goldblatt 215, Mauve 4777*) have plane, linear leaves 1 to 2 mm wide. The flowers are relatively large for the genus, 50–58 mm in diameter, and predominantly pale lilac, mauve, or creamy yellow with the outer tepals each marked with a dark bronze-brown blotch in the lower half, edged in pale blue or turquoise. The outer tepals are obovoid and relatively small, ca. 20 mm long, compared with the inner, which are panduriform and 24–28 mm long.

Aristea teretifolia and *A. lugens* are the only two species of the genus in which the outer tepals have large, dark markings and are substantially smaller than the inner. In *A. lugens* the inner tepals are whitish or pale blue with the color darker toward the apices, and the outer tepals are blue-black in the upper two-thirds (Ker Gawler, 1810; Weimarck, 1940; Oliver, 1973). This is quite different from the tepal coloring in *A. teretifolia*. The dimensions of the flowers of the two species also differ. Those of *A. lugens* have the outer tepals up to 25 mm long and the inner to 50 mm (Oliver, 1973), the latter more or less 50% larger than in *A. teretifolia*, which has the outer tepals ca. 20 mm and the inner 24–28 mm long. The leaves of *A. lugens* have plane blades 3–6 mm wide with transparent, acutely angled margins more or less typical of the genus and sharply different from the terete or narrow leaves of *A. teretifolia*. Despite the superficial morphological similarity between *A. teretifolia* and *A. lugens* they are clearly separate species and, we suspect, are not immediately related to one another.

The relationships of *Aristea teretifolia* are more likely to be with *A. biflora*. This species also has lilac or mauve flowers and shares with *A. teretifolia* the curious feature of having the outer tepals asymmetric about the midline, the right half larger than the left (Fig. 1B, D). The flowers of *A. biflora* do, however, lack dark markings on the outer tepals. Instead, the outer tepals each have a pair of remarkable transparent round windows at their lower sides. These windows, which appear dark when

viewed from above against the dark green of the ground cover, perhaps function in the same way as patches of dark pigmentation, providing a signal to potential pollinating insects. *Aristea biflora* has more or less linear, plane leaf blades, 2–5.5 mm wide, and grows in dense clumps reminiscent of the growth form of *A. teretifolia*, and like that of other species of section *Pseudaristea*. *Aristea lugens*, however, has somewhat falcate leaves and does not grow in discrete clumps, instead forming spreading mats.

Aristea teretifolia occurs along the lower slopes of the Bredasdorp Mountains in Western Cape Province, South Africa. It is apparently most common in renosterveld along the northern slopes of the range. It has also been recorded near Elim and Stanford on the southern slopes of the Bredasdorp Mountains, near Rietpoel, and on the northern slopes of Shaw's Mountain near Caledon (Fig. 2). *Aristea biflora* grows a short distance to the north on the lower southern slopes of the Caledon Swartberg, while *A. lugens* occurs only west of the Hottentots Holland Mountains, extending along the low Kuils River, Paarl, and Paardeberg Mountains as far north as Riebeeck Kasteel near Malmesbury. All three favor fairly heavy soils, granitic in origin for *A. lugens*, or from shale for *A. bifora* and *A. teretifolia*, and grow in renosterveld or transitional renosterveld–fynbos vegetation. The pollination system of *A. teretifolia* corresponds closely to that of *A. cantharophila*. The only visitors we observed were a species of the Hopliine beetle, *Lepithrix*, common in the Napier area and seen visiting the flowers of several other species, notably including *Homeria elegans* (Jacquin) Sweet (Iridaceae), which has predominantly yellow flowers with dark green or orange spots on the outer tepals. These dark brown beetles have a narrow pale line along the inner edges of their elytra and a halo or pale hairs on their lower bodies. The size and appearance of these insects closely matches the outer tepal markings of *A. teretifolia*. The correspondence is so striking that we assume they mimic these beetles and thus encourage more frequent visits to the flowers.

Paratypes. SOUTH AFRICA. **Western Cape:** 3419 (Caledon) N side of Shaw's Pass (AD), 7 Sep. 1968, *Goldblatt 215* (BOL); top of Shaw's Pass, roadside, 19 Sep. 1968, *Mauve 4777* (PRE); 6 mi. W of Rietpoel, just beyond railway crossing (BB), 22 Aug. 1962, *Taylor 3746* (NBG, PRE); farm near Stanford (BC), Sep. 1924, *L. Guthrie s.n.* (BOL 17855); between Oudekraal and Napier (BC), Sep. 1933, *Garside s.n.* (BOL 21921); Fairfield Estate W of Napier, 5 Sep. 1994, *Nänni 44* (NBG), Oct. 1993 (fr), *Nänni s.n.* (NBG); hills near Elim (DA–DB), 14 July 1895, *Guthrie 3823* (NBG); Kouerivierberg near Elim, 17 Sep. 1932, *Nel s.n.* (NBG); 3 km S of Viljoenshof, fynbos-renosterveld (DA), 13 Sep. 1981, *van Wyk 646* (NBG, PRE); Bredasdorp–Elim road, Farm Boskloof (DB), 3 Sep. 1983, *Vlok 659* (NBG).

Key to the Species of Section *Pseudaristea*

Ovary on pedicels 5–18(–25) mm long, cylindric-trigonous or cylindric triangular, 8–17(–22) mm long; lateral inflorescences usually present and nearly always sessile, occasionally the lowermost on a slender branch; terminal flower clusters binate rhipidia with 2–4 flowers, the outer spathe pair prominent and concealing the buds entirely; pollen usually orange, sometimes yellow; capsules leathery, elongated, 20–70 mm long, tardily dehiscent, with an acute beak; pollen grains dizonasulculate and with exine reticulate.

1. Stems broadly winged above the first flower cluster (or uppermost leaf if lateral flower clusters lacking); filaments short, 8–10 mm long, or much longer than the anthers and 14–18 mm long; flowers facing to the side . . . . . *A. spiralis*
1′. Stems not broadly winged above the first flower cluster or uppermost leaf; filaments short, as long as or not much longer than the anthers, 3–6.5 mm long; flowers either facing to the side or upright.
2. Outer tepals differentiated from the inner, both smaller in size and each either with a dark basal or distal marking or with a pair of large transparent windows in the lower halves.
3. Outer tepals dark brown- or blue-black in the upper halves and nearly symmetric about the midline; inner tepals about twice as long as the outer . . . . . *A. lugens*
3′. Outer tepals the same color as the inner tepals in the upper halves and asymmetric about the midline; inner tepals slightly longer than the outer, not twice as long.
4. Outer tepals each with a large, dark bronze-brown mark near the base; leaves terete or linear, ca. 1 mm diam . . . . . *A. teretifolia*
4′. Outer tepals not darkly colored below, but each with paired translucent windows of membranous tissue above the base; leaves linear, (2–)3–5.5 mm wide . . . . . *A. biflora*
2′. Outer tepals about the same size or slightly smaller than the inner and similarly colored.
5. Tepals cream or lilac to light mauve with dark purple or greenish black at the base, the center of the flower thus with a dark central eye . . . . . *A. cantharophila*
5′. Tepals shades of light to dark blue, pale greenish yellow in the center.
6. Flowers upright, dark blue; capsule lobes strongly angular . . . . *A. pauciflora*
6′. Flowers facing to the side, pale blue; capsule lobes rounded . . . . *A. simplex*

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Ocotea morae (Lauraceae): A New Species from Costa Rica

Jorge Gómez-Laurito
Escuela de Biología, Universidad de Costa Rica, Ciudad Universitaria 2060, San José, Costa Rica

ABSTRACT. A new large-fruited species of Lauraceae is described and illustrated here. *Ocotea morae* is found on the Cordillera de Tilarán, Costa Rica.

RESUMEN. Una especie nueva de Lauraceae de frutos muy grandes se describe y se ilustra en este artículo. *Ocotea morae* se encuentra en las faldas de la Cordillera de Tilarán, Costa Rica.

The Reserva Biológica Alberto M. Brenes (formerly Reserva Forestal de San Ramón) is a 7800-hectare field station managed by the University of Costa Rica. The station is located near the San Lorencito River on the wet Caribbean slope of the Fila Volcán Muerto, Cordillera de Tilarán, province of Alajuela, 10°13′N, 84°37′W, at 850 m elevation. The average annual rainfall is about 3500 mm. The elevation varies from about 600 m on the northeastern edge of the property to 1520 m in the Cerro Jabonal. During fieldwork in this preserved forest I collected a remarkable new species of the genus *Ocotea* Aublet (Lauraceae).

Ocotea morae Gómez-Laurito, sp. nov. TYPE: Costa Rica. Alajuela: San Ramón, Reserva Biológica Alberto M. Brenes, 10°13′N, 84°37′W, 800–850 m, 27 Aug. 1995 (fl, fr), *J. Gómez-Laurito & V. Mora 12817* (holotype, USJ; isotypes, CR, F, MO). Figure 1.

Ocoteae dendrodaphne et affinibus similis, sed trunco usque ad 22 m alto et 80 cm diametro, cupula magna, 15–20 mm profunda, 45–65 mm lata, conspicue (usque 15 mm) marginata; bacca 53–58 mm longa et 42–60 mm lata a speciebus satis notis bene distincta.

Trees 18–22 m tall, 60–80 cm DBH, trunk straight, terete with medium-sized buttresses; bark grayish, lenticellate; inner bark yellowish, hard. Leafy branchlets minutely appressed pubescent to glabrescent, solid, but sometimes the distal stems hollow (no ants have been seen). Leaves alternate; petioles 12–20 mm long, sulcate above; lamina 18–24 × 5–8 cm, oblong-elliptic, tapering to a short-acuminate apex, obtuse at the base and slightly decurrent on the petiole, the margin entire and revolute at the base, drying chartaceous and grayish green, glabrous and slightly lustrous on both surfaces, with 14–20 pairs of major secondary veins, tertiary venation reticulate and very slightly raised beneath. Inflorescence solitary and axillary to distal leaves or leafless nodes near the shoot tip, panicles 2–5 cm long, compact, with very short lateral branches and several crowded flowers. Flowers white, 6–10 mm long; 6 tepals 3–5 × 3 mm, externally densely pubescent, internally pubescent with brownish to ferrugineous curly hairs, papillose; 9 fertile stamens with the cells arranged in 2 pairs, 6 outer with a sterile apical tip, 3 inner with the cells lateral-introrse, subsessile, thick, fleshy, smooth, with curly hairs at the base of the filaments; glands sessile at the base of the inner filaments. Ovary ovoid, glabrous. Style 1 mm long, capitate. Cupule cup-shaped, 15–10 mm deep, 45–65 mm broad, with a conspicuously wide-flaring (to 15 mm) outer margin, lenticellate. Berry ellipsoid to subglobose, 53–58 × 42–60 mm, green.

It is my pleasure to name this species for Victor Mora, a long-time friend and resident biologist of the reserve, for his courage and devoted care in the preservation and study of this rich forest.

The subgenus *Dendrophne* can be separated from the subgenus *Ocotea* by its 6 outer stamens with an apical sterile tip, the papillose anthers, and double-margined cupule. Sterile collections of *O. morae* are similar to those of *O. dendrodaphne* Mez; the latter, however, is a shrub or small treelet with fruit cups 8–10 mm long, ca. 15 mm broad, and 3–7 mm deep, and berries 15–25 mm long and 10–12 mm thick (Burger & van der Werff, 1990). *O. morae*, on the other hand, is a large tree to 22 m tall and the aspect of fruiting collections of this new species is quite unlike other *Ocotea* species in Costa Rica. It can be readily recognized by its large cupule to 65 mm broad, and fruit to 58 mm long and 60 mm wide. *Ocotea morae* is at present only known from the type locality.

Paratypes. COSTA RICA. **Alajuela:** same locality as type: 30 July 1992 (fl), *J. Gómez-Laurito et al. 12274* (CR,

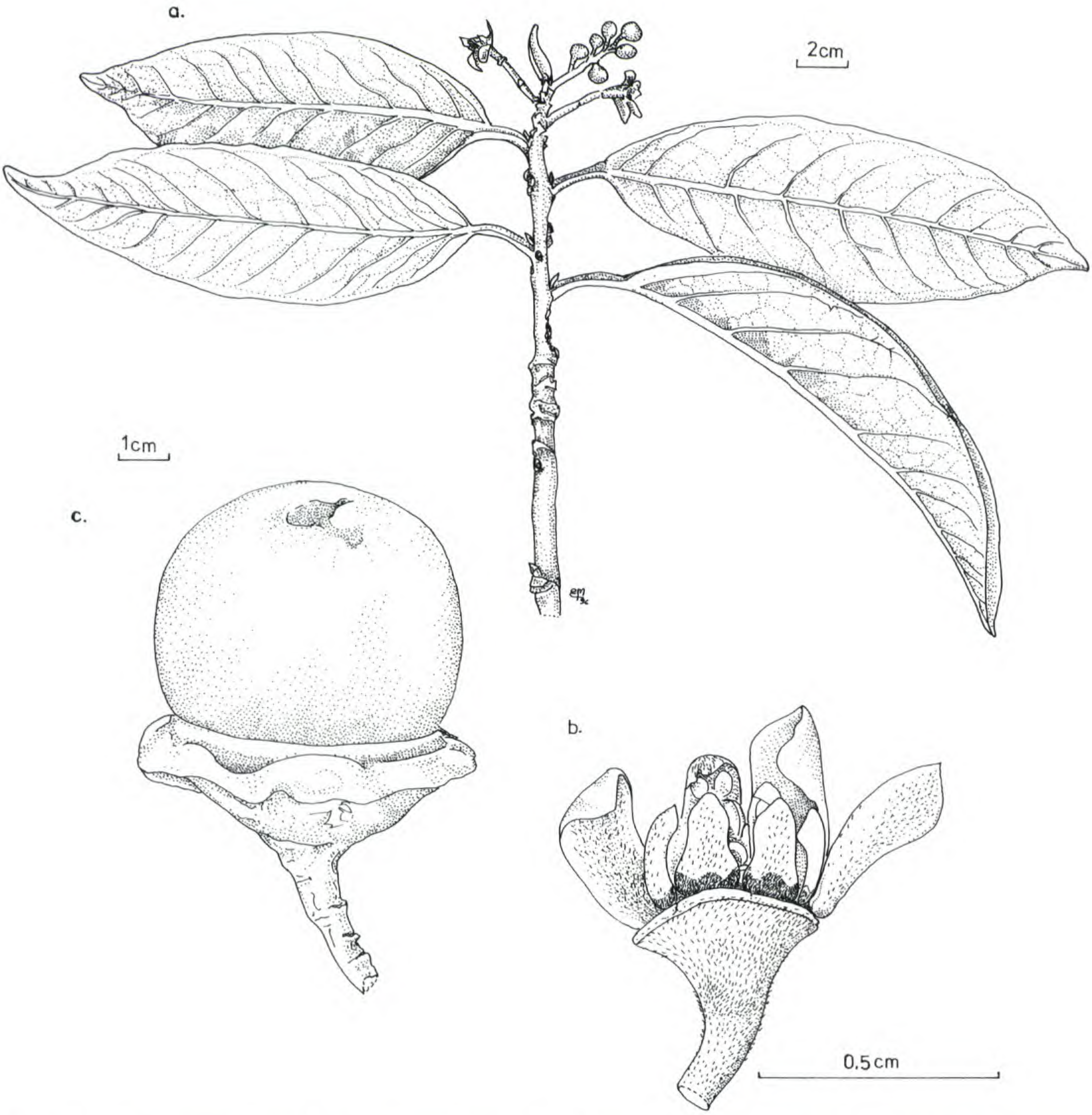

Figure 1. *Ocotea morae* Gómez-Laurito (*Gómez-Laurito & V. Mora 12817*). —a. Habit. —b. Flower with some tepals removed. —c. Fruit.

F, MO, USJ), 27 Aug. 1994 (fr), *J. Gómez-Laurito et al. 12676* (USJ).

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Three New Species of Celastraceae from Costa Rica, One Disjunct from Mexico

Barry E. Hammel
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. Three species of Celastraceae, each represented by many collections from Costa Rica, are compared to near relatives and found to be new: *Gymnosporia haberiana* Hammel, disjunct from Mexico and Costa Rica; *Maytenus recondita* Hammel, of Costa Rica and Panama; and *Crossopetalum enervium* Hammel, of Costa Rica. The South American *Gymnosporia magnifolia* (Loesener) Lundell is here confirmed as a synonym of *G. urbaniana* (Loesener) Liesner, and *Crossopetalum eucymosum* (Loesener & Pitter) Lundell is placed in synonymy under *C. parviflorum* (Hemsley) Lundell. Keys are provided for all accepted neotropical species of *Gymnosporia*, and for all Costa Rican species of *Crossopetalum* and *Maytenus*.

For nearly 20 years collections of two large, cloud forest trees in the family Celastraceae have been accumulating, primarily from the Monteverde region of Costa Rica. Much of this material has been distributed to various herbaria under tentative or approximate names. More recent exploration along the central cordillera has extended the range, within Costa Rica, of these two species and yielded many collections of a third, shrubby species in the genus *Crossopetalum*, also known from the Monteverde region. The two trees are known almost exclusively from mid-elevations on the Pacific slopes of the northern mountains, while the shrub extends nearly the entire length of the country and is known from numerous collections on both slopes.

Although one of the trees has always been known to be a *Maytenus* presumably related to *M. schippii* Lundell, generic placement of the other has been more problematic. This species, while having alternate leaves and capsulate fruits with arillate seeds, as in *Maytenus*, has greener drying, entire leaves, more open and branched inflorescences with 4-merous flowers, and several-seeded, 2–4-lobed fruits. In these respects the Costa Rican (and Mexican) tree can be distinguished from other alternate-leaved Celastraceae and coincides perfectly with two South American species recently described in or transferred to the genus *Gymnosporia* (Lundell, 1985; Liesner, 1993).

Gymnosporia haberiana Hammel, sp. nov. TYPE: Costa Rica. Guanacaste: Cordillera de Tilarán, La Cruz de Abangares, 1400 m, 15 July 1985 (fl), *Haber & Bello 2034* (holotype, INB; isotypes, BM, C, CAS, COL, CR, DUKE, F, FLAS, GH, HNMN, K, MEXU, MICH, MO, NY, P, PMA, TEX, US, USJ, W, WIS). Figure 1.

A *G. gentryi* Lundell foliorum nervis lateralibus minus prominentis et latiore divergentibus, ovario et capsula tantum lobato non anguloso, a *G. urbaniana* floribus majoribus, disco manifesto, ab ambobus sepalis latioribus quam longioribus.

Dioecious trees (3–)5–30 m, the inner bark bright yellow; twigs terete; leaves and twigs drying pale to yellowish green, glabrous. Leaves alternate, 7–12(–14) × 3–6(–8) cm, elliptic, the apex acute to acuminate, the base acute to rounded, the margin entire and often curled under, all leaves often folded and curved along the midrib; main lateral veins mostly 4 or 5; petioles 5–10 mm; stipules small, deciduous. Inflorescences 2- or 3-branched, ca. 10–20-flowered axillary cymes, the rachis minutely and sparsely farinose-puberulent, the pedicels 2–4 mm. Flowers 4-merous, ca. 4.5–7 mm wide, greenish; sepals ca. 0.4 × 1 mm, broadly rounded; petals imbricate, ca. 0.4 × 1 mm, spatulate or ligulate ca. 0.4 × 1 mm; stamens exceeding the style in staminate (pollen-bearing) plants, shorter than the style and without pollen in pistillate plants, anthers ± cordate, versatile; ovary ± globose, confluent with the conically raised disk, 2-celled with 2 ovules per cell. Fruits ca. 1 × 1–1.5 cm, globose or often wider than long and 2–4-lobed, (1)2–4-seeded; seeds dark brown with white aril.

Additional specimens examined. COSTA RICA. **Alajuela:** Cordillera de Guanacaste, P. N. Rincón de la Vieja, 10°47′50″N, 85°18′19″W, 1500 m, 6 July 1991(fl), *Rivera 1423* (CR, F, INB, MICH, MO, USJ, W). **Guanacaste:** Cordillera de Guanacaste, P. N. Guanacaste, Volcán Cacao, ca. 10°55′45″N, 85°28′15″W, 1100–1400 m, 25 Nov. 1989 (fr), *Chávez 7* (CR, F, MO), Dec. 1990 (fr), *478* (CR, F, INB, MO), July 1989 (fl), *Hammel 17661* (BM, CAS, COL, CR, F, INB, MEXU, MO, TEX, US), 9 Feb. 1995 (fr), *Quirós 48* (CR, INB, MO); P. N. Rincón de La Vieja, sendero al Volcán, 10°45′50″N, 85°19′50″W, 820 m, Jan. 1991 (fr), *Rivera 974* (CAS, CR, F, INB, MO). **Puntar-**

Figure 1. *Gymnosporia haberiana* Hammel. —A. Fruiting shoot. —B. Staminate flowers. —C. Pistillate flowers. —D. Fruit. (A, D from *Haber & Zuchowski 11048*; B from *Hammel 17661*; C from *Haber 9303*.)

enas: Cordillera de Tilarán, Monteverde Reserve and vicinity, ca. 10°20′N, 84°50′W, 1200–1550 m, 4 Mar. 1990 (fr), *Bello 2110* (F, INB, MO, MV), 28 July 1977 (fl), *Dryer 1589* (CR, MO), 4 Apr. 1985 (fr), *Haber & Bello 1458* (BM, CAS, CR, F, LL, MEXU, MO, US), 12 July 1985 (fl), *Haber & Bello 1984* (BM, COL, CR, F, LL, MEXU, MICH, MO, P, UPS, W), 29 Nov. 1985 (fr), *Haber ex Bello 3591* (BM, CR, LL, MO), 17 Dec. 1985 (fr), *Haber ex Bello 3935* (CAS, CR, DUKE, F, LL, MEXU, MO), 22 July 1986 (fl), *Haber ex Clagget 5738* (CR, F, GH, LL, MO), 27 Feb. 1987 (fr), *Haber & Bello 6728* (INB, LL, MO), Feb. 1988 (fr), *Haber & Bello 8213* (F, INB, LL, MO, US), 20 July

1989 (fl), *Haber 9303* (CR, F, INB, MEXU, MO, TEX), 26 Mar. 1990 (fr), *Haber 9815* (CR, INB, MO, US), 30 July 1991 (fl), *Haber & Zuchowski 10789* (CR, INB, MO), 12 Mar. 1992 (fr), *Haber & Zuchowski 11048* (CR, F, INB, MO), 27 July 1977 (fl), *Hartshorn 1901* (CR, F), 25 Jan. 1984 (fr), *Pennington 11432* (CR, MO). MEXICO. **Veracruz:** Estación Biológica Los Tuxtlas, 18°35′N, 95°05′W, 300 m, no date (st), *Calzada 79* (F), 29 Nov. 1974 (fr), *Cedillo 436* (MO), 4 Feb. 1986 (fl), *Cedillo 3518* (MO), 24 June 1984 (fl), *Ibarra & Sinaca 1787* (MO), 15 Nov. 1984 (fr), *Ibarra et al. 2124* (MO), 20 Jan. 1985 (fr?), *Ibarra & Sinaca 2240, 2241* (MO), 4 July 1985 (fl), *Sinaca 122* (MO).

Distribution and biogeography. Gymnosporia haberiana is disjunct between one site at about 300 m elevation in Veracruz, Mexico, and several wet-forest, mid-elevation sites in northwestern Costa Rica (Fig. 2). However, its nearest relatives, as discussed below, are from low- and mid-elevation South America, a common pattern for tropical Mexican and Central American taxa (e.g., Hammel, 1986, and references therein). Nevertheless, *G. haberiana* is not known from southern Costa Rica or from Panama. This disjunct distribution between Mexico (or northern Central America) and Costa Rica, then skipping Panama to nearest relatives in South America, is not unique (e.g., *Ziziphus chloroxylon* (L.) Oliver), and if not an artifact of collecting, may itself reflect the complex geological history of the isthmian region.

Relationships. The closest relatives of *Gymnosporia haberiana* are its two South American congeners. In 1985 Lundell transferred *Maytenus magnifolia* Loesener to *Gymnosporia* and described a second neotropical species, *G. gentryi*, thus reinstating for the New World an essentially African genus that had come to be considered congeneric with *Maytenus*. In contrast to species of *Maytenus*, most of which (at least in the Neotropics) have small fasciculate inflorescences, 5-merous flowers, 1- or rarely 2-seeded fruits, and often toothed, gray- or tan-drying leaves, the New World *Gymnosporia* have relatively large, open cymose inflorescences, 4-merous flowers, usually 2–4-seeded fruits, and entire, greenish-drying leaves (see also Hou, 1955). Study of specimens and bibliographic material at MO supports Liesner's conjecture (1993) that *G. urbaniana* (the older name) and *G. magnifolia* are conspecific:

Gymnosporia urbaniana (Loesener) Liesner, Monogr. Syst. Bot. Missouri Bot. Gard. 45: 1254. 1993. *Rhacoma urbaniana* Loesener Repert. Spec. Nov. Regni Veg. Vol. 1(11): 162. 1905. TYPE: Peru. *Weberbauer 1875* (photo MO).

Gymnosporia magnifolia (Loesener) Lundell, Phytologia 57: 314. 1985. Syn. nov. *Maytenus magnifolia* Loesener, Vernh. Bot. Vereins Prov. Brandenburg 48: 176. 1906 (1907). TYPE: Brazil. Amazonas: Flusse Juruá Miry, *Ule 5721* (photo MO).

The new species differs from *Gymnosporia gentryi* of Colombia and Ecuador and *G. urbaniana* of Amazonian Brazil, Peru, and Bolivia by its generally smaller leaves with less conspicuous lateral veins, usually fewer-flowered inflorescences, and sepals that are much broader than long. *Gymnosporia urbaniana* has smaller flowers with almost no nectar disk and is found mostly in lowland Amazonia. *Gymnosporia gentryi*, from 1200 to 2800 m in the northern Andes, has flowers nearly as large as those of *G. haberiana*, but the ovary (and fruit) is distinctly 4-angled and its leaves have very prominent (below) lateral veins that depart from the midrib at a much narrower angle. By these observations, *G. haberiana* and *G. gentryi* appear to be sister species. The three neotropical species of *Gymnosporia* can be separated according to the following key:

1a. Flowers mostly < 4 mm wide, sepals ca. 0.5 mm wide and equally long; filaments widening toward base, but nectar disk inconspicuous; smallest twigs green; plants mostly Amazonian, from below 800 m . . . . . *G. urbaniana*

1b. Flowers > 5 mm wide, sepals ca. 1 mm wide, much shorter than wide or equally long; filaments scarcely widening toward base, nectar disk conspicuous; smallest twigs red or green; plants Andean or north of Panama, from above 1200 m.

2a. Leaves mostly 18–20 cm long, the lateral veins very prominent, arching strongly forward at < 45°; smallest twigs with reddish exfoliating epidermis; ovary (and fruits) distinctly 4-angled; sepals as wide as long or slightly wider; Ecuador, Peru, Bolivia . . . . . *G. gentryi*

2b. Leaves < 14 cm long, the lateral veins not prominent, arching outward mostly at 50° or more; smallest twigs green; ovary globose, the fruits often 4-lobed but not angled; sepals much wider than long; Mexico and Costa Rica . . . . . *G. haberiana*

Mexican material of this species has sometimes been tentatively identified as *Maytenus grisea* Lundell, but examination of the Guatemalan type of that species (*Contreras 6944*, LL) shows *G. haberiana* to be quite distinct. Although the two species are superficially similar because of their somewhat inflated and relatively thin-walled fruits, in contrast to the open cymes and lobed fruits of *G. haberiana*, the inflorescences of *M. grisea* are only pedicellate clusters on a very short or obsolete peduncle, the fruits are not lobed, and the leaves are toothed and

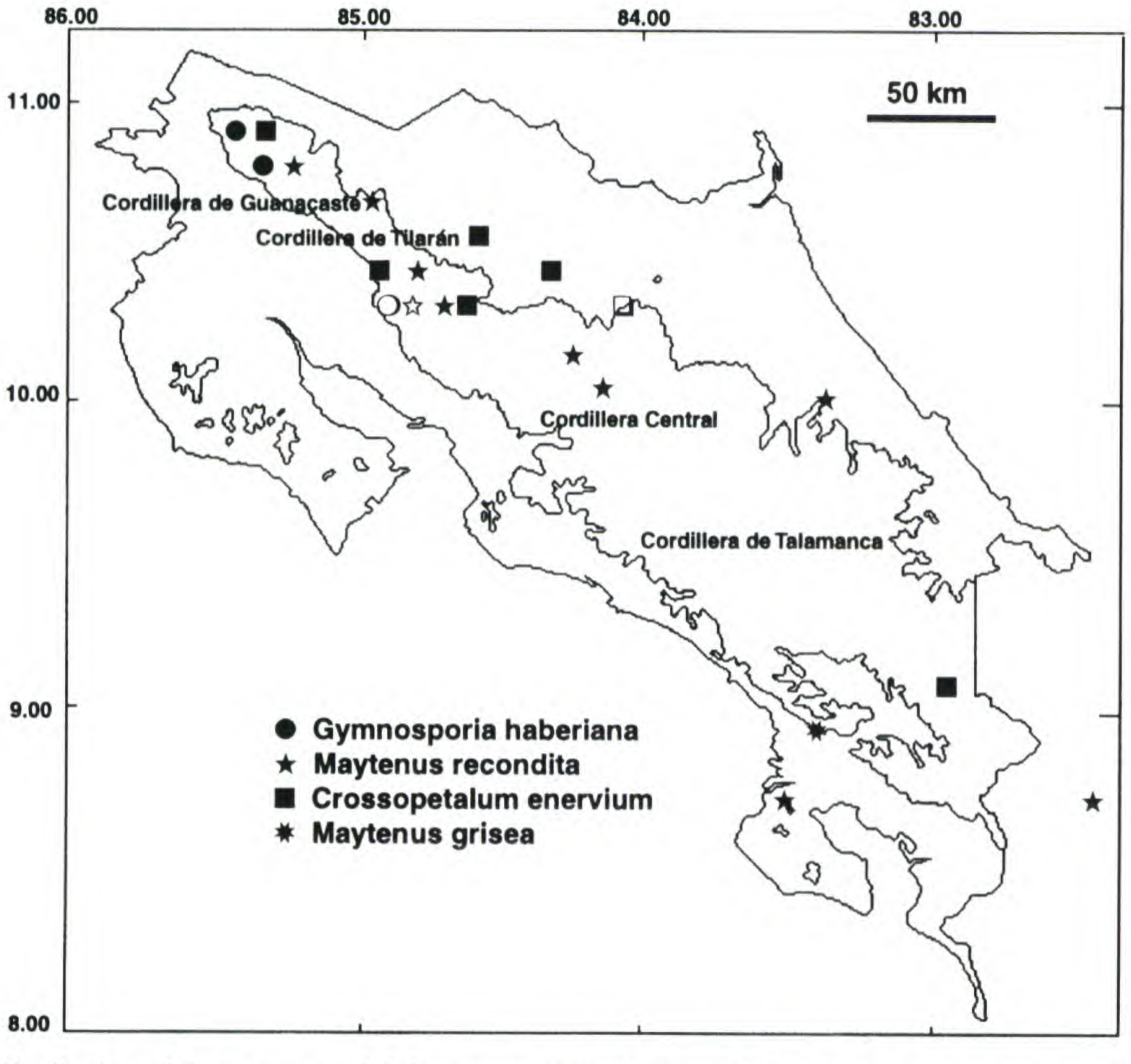

Figure 2. Distribution of four species of Celastraceae in Costa Rica (hollow symbols mark type localities; 500 m contour is indicated).

dry gray rather than green. Unexpectedly, this study has revealed that a rarely collected Costa Rican plant from hills near Palmar Norte (*Allen 6327*, F [as "Maytenus pallidifolius Standley & L. O. Williams ined."]; *Bohlke 20*, F; *Hammel et al. 20296*, INB; *Poveda & Hoet 3050*, CR) is certainly conspecific with *M. grisea*. Thus, *M. grisea*, known only from the type in Guatemala and now from southern Costa Rica (Fig. 2), is similar to *G. haberiana* in being disjunct within the region.

Etymology and history. This new species is dedicated to my friend and colleague, William Haber, long-time student and professor of the rich flora of Monteverde, Costa Rica, locality of the type and most other collections cited here. Bill's keen observation and field notes brought to my attention the dioecious nature of this species. The earliest known collection of this species is from Mexico (*Cedillo 436*, Nov. 1974). In Costa Rica it was apparently first collected in July 1977 (*Dryer 1589*).

Maytenus recondita Hammel, sp. nov. TYPE: Costa Rica. Puntarenas: Cordillera de Tilarán, Monteverde community, 10°18′N, 84°48′W, 1350 m elev., 11 July 1989 (fl), *Haber & Zuchowski 9286* (holotype, INB; isotypes, CR, F, MICH, MO, US). Figure 3.

A *M. schippii* atque *M. guyanense* inflorescentiis cymoso-paniculatis, foliis in sicco viridi-griseis aut fuscis, praesentia altitudinis majoris differt.

Dioecious trees 5–25 m; twigs usually zig-zag, terete. Leaves alternate, (5–)7–11 × 2–5 cm, elliptic, the apex acuminate, the base decurrent, shallowly toothed in the distal ½ or without teeth, with 4–7 indistinct lateral veins, these looping and not reaching the margin, glabrous, drying dark, gray-brown above, gray-green below; petioles 2–5 mm; stipules small, triangular, ± persistent. Inflorescences small, usually 1–4(–8)-flowered, axillary cymose, panicles, the rachis 1–7 mm, the pedicels 1–2 mm, occasionally proliferating on ± leafless branchlets up to 4 cm long. Flowers 5-merous, ca. 3–4 mm across, pale green; sepals ca. ½ or less the length of the petals, rounded, ± erose-margined; petals 1 × 1 mm at base, ± triangular; stamens yellow, born on the margin of a flat disc ca. 1.5 mm wide, the filaments ca. 0.5–0.6 mm. Capsules bivalvate mostly 1 or 2 (to 6) per axis, obovoid, 10–15 mm, bright orange, usually 1- or occasionally 2-seeded; seeds with a white aril.

Additional specimens examined. COSTA RICA. **Alajuela:** Cordillera de Guanacaste, entre Río Celeste y ca-

Figure 3. *Maytenus recondita* Hammel. —A. Flowering shoot. —B. Pistillate flowers. —C. Fruits. (A, B from *Hartshorn 1895*; C from *Haber & Zuchowski 8737*.)

beceras del Río Chimurria, 10°43′15″N, 85°00′20″W, 700–800 m, July (fl & fr), *Herrera 2008* (F, INB, MO); Cordillera de Tilarán, altos del Río Caño Negro, 10°21′N, 84°48′W, 1300 m, 17 Sep. 1989 (fl), *Bello 1376* (INB, MO); (Puntarenas, by error, on labels) Bosque Eterno De Los Niños, 10°23′N, 84°42′W, 1100 m, fl Apr., *Bello et al. 2156* (CAS, CR, F, INB, MO, W); 10°24′N, 84°39′W, 800–900 m, 17 July 1993 (fr), *Haber et al. 11544* (CAS, CR, F, INB, MICH, MO, W); Parque Nacional Juan Castro Blanco, 10°15′30″N, 84°15′30″W, 1200 m, 26 June 1993

(fl, fr), *Jiménez 1327* (COL, CR, F, INB, MO); Parque Nacional Arenal, 10°25′N, 84°43′W, 1200 m, 18 Sep. 1990 (fl), *Bello 2403* (INB); Peñas Blancas River Valley, 10°20′N, 84°50′W, 1250 m, 12 Oct. 1985 (fr), *Haber ex Bello 3100* (CR, F, MO); Reserva Biológica de San Ramón, 10°17′N, 84°36′W, 1000 m, 16 Feb. 1994 (fl), *Herrera 6894* (CR, USJ). **Guanacaste:** Cordillera de Guanacaste, Parque Nacional Rincón de La Vieja, cabeceras de Quebrada Rancho Grande, 10°46′N, 85°49′W, 1350–1400 m, 2 Dec. 1987 (fr), *Herrera 1474* (MO); Cordillera de Tilarán, 3 km N Santa Elena, ca. 10°20′N, 84°50′W, 1500 m, near 20 Dec. 1985 (fr), *Haber ex Bello 3824* (CR, F, MO), *3831* (CR, F, MO), *3863* (CR, MO); 5 km N Santa Elena on road to Las Nubes, 10°22′N, 84°49′W, 1400 m, 10 Nov. 1988 (fr), *Haber & Zuchowski 8737* (INB, MO); Río Negro de Tilarán, 1500 m, 4 Oct. 1985 (fl, fr), *Haber & Bello 2989* (CR, F, MO); 10°21′N, 84°49′W, 1400 m, 27 May 1987 (fl), *Haber & Bello 7125* (F, MO). **Heredia:** Cordillera Central, vicinity of Vara Blanca, 1710 m, Apr. 1938 (fl), *Skutch 3765* (MO, US); Volcán Barva, 1700–2000 m, 24 May 1972 (fl, fr), *Stone 3261* (CR, F, MO). **Limón:** Cordillera de Talamanca, Z. P. Barbilla, frente a confluencia entre Río Caño Seco y Río Dantas, 10°N, 83°26′W, 150–350 m, 3 Nov. 1988 (fl), *Herrera 2278* (F, MO). **Puntarenas:** Cordillera de Tilarán, Monteverde Reserve and vicinity, ca. 10°20′N, 84°50′W, 1000–1700 m elev., 25 May 1989 (fl), *Bello 922* (INB, MICH, MO, TEX, US), 21 Nov. 1991 (fl), *Bello 4164* (INB), 17 to 20 Mar. 1973 (fr), *Burger & J. Gentry 8601* (CR, F), 30 Oct. 1976 (fl, fr), *Dryer 933* (CR, F, MO), 15 Dec. 1976 (fr), *Dryer 1082* (CR), 13 Jan. 1977 (fl, fr), *Dryer 1125* (CR, F, MO), *Gentry & Haber 48761* (F, MO), 20 Mar. 1976 (fl, fr), *Gómez-Laurito et al. 1402* (USJ), 5 Aug. 1978 (fl, fr), *Haber 162* (CR), *Haber 446* (F, MO), *692* (F, MO), *693* (F, MO), 20 Oct. 1985 (fl), *Haber ex Bello 3108* (CR, MO), 20 Oct. 1985 (fr), *Haber ex Bello 3117* (CR, F, MO), 10 Dec. 1985 (fr), *Haber ex Bello 3673* (CR, MO), 16 Jan. 1986 (fl, fr), *Haber ex Bello 4266* (CR, F, MO), 2 May 1974 (fl), *Hartshorn 1470* (CR 4 sheets, F, MO), 19 Feb. 1976 (fr), *Hartshorn 1820* (F), 26 July 1977 (fl), *Hartshorn 1895* (CR 3 sheets, F, MO), 19 Aug. 1995 (fl, fr), *Penneys & Zuchowski 683* (CR, F, INB, MO, TEX), 8 Aug. 1975 (fl, fr), *Poveda 1110* (CR, F, MO, USJ); Cordillera de Tilarán, Ojo de Agua, Río Aranjuez, 10°17′N, 84°46′W, 1550 m, 14 Nov. 1987, *Haber & Bello 7738* (F, MO); San Luis, Cerro Amapola, 10°16′33″N, 84°47′45″W, 1100 m, 23 Nov. 1993 (fr), *Fuentes 583* (INB, MO); Península de Osa, Quebrada Agua Buena, 08°42′40″N, 83°31′00″W, 500 m, 13 Mar. 1996 (fl), *Aguilar 4524* (CR, INB, F, MO). PANAMA. **Chiriquí**: Bajo Mono-Robalo trail ca. 1500–2100 m, 27 July 1947 (st), *Allen 4844* (F).

Distribution. Except for one sterile collection from western Panama, *Maytenus recondita* is restricted to wet forests of central Costa Rica (Fig. 2), primarily at 700–1700 m elevation on the Pacific slope from the Cordillera de Guanacaste to the Cordillera Central, with one low-elevation, Atlantic-slope collection from the Río Barbilla region, Cordillera de Talamanca (*Herrera 2278*) and another isolated collection from the Osa Peninsula (*Aguilar 4524*).

Characterization. This species is recognized by the acuminate and decurrent, gray-green-drying leaves and the paniculate inflorescence of reduced or aborted cymes. It is generally a larger tree as compared to *M. segoviarum* Standley & Steyermark, with which it is sympatric in Costa Rica. It has been identified in the past as *M. schippii* Lundell "vel. sp. aff.," but differs from *M. schippii* by its shorter petioles, branched, pedunculate (rather than fasciculate) inflorescences, and higher-elevation habitat. Another similar species, currently identified in Costa Rica as *M. guyanensis* Klotzsch ex Reissek, differs by its much larger, usually darker drying leaves, fasciculate inflorescences, and lower-elevation habitat. The five species of *Maytenus* recognized for Costa Rica can be distinguished by the following key:

1a. Leaves distinctly serrulate with gland-tipped teeth; base of peduncle densely covered with ferrugineous, laciniate bracteoles; plants from > 2000 m . . . . . *M. woodsonii* Lundell

1b. Leaves entire or indistinctly toothed; ferrugineous bracteoles sparse or lacking; plants from 0 to 1700 m.

2a. Largest leaves 12–20 cm; plants from below 500 m elev.

3a. Leaves and fruits drying dark gray to brownish black; inflorescence ± racemose or fasciculate from a short peduncle; fruits obovoid, not inflated; plants mostly from P. N. Manuel Antonio and Osa Peninsula, near sea level . . . . . *M. guyanensis*

3b. Leaves and fruits drying pallid gray-green, mottled; inflorescence fasciculate, mostly without peduncle; fruits globose inflated; Palmar Norte, 450 m. . . . . *M. grisea*

2b. Largest leaves ≤ 11 cm; plants from 40 to 1700 m.

4a. Leaf apex narrowly acuminate, sometimes mucronate, the base markedly decurrent, the leaves drying dark gray-green to greenish tan; inflorescence paniculate-cymose; fruits short-pedicellate from an obvious rachis; plants mostly of cloud forest, (150–)700–1700 m . . . . . *M. recondita*

4b. Leaf apex acute to rounded, often retuse, the base acute, the leaves drying light gray to tan; inflorescences fasciculate; fruits arising from a knob; plants mostly of drier slopes below cloud forest, 40–1100 m . . . . . *M. segoviarum*

Anthers on flowering material of *Maytenus recondita* also bearing young fruits appear (on close examination) not to bear pollen. Although the relative length of stamens and style does not differ strikingly in staminate and pistillate flowers, as in the above-discussed species of *Gymnosporia*, *M. recondita* must also be dioecious.

A series of collections from Costa Rica (*U. Chavarría 179*, INB; *Chávez 248*, INB; *Ezpinoza 1186*,

INB; *G. Herrera 850*, INB; *A. Rodríguez 188*, INB) is here specifically excluded from the concept of *Maytenus recondita*. This entity shares the elevational range, inflorescence type, and leaf color of *M. segoviarum*, but has a leaf shape more similar to that of *M. recondita*. It is not yet decided whether these collections represent a sixth species for Costa Rica, hybrids between *M. recondita* and *M. segoviarum*, or simply variation within *M. segoviarum*.

Etymology and history. The epithet recondita ("hidden, unpretentious") was chosen for this species because its primary distinction is its reduced but nevertheless branched inflorescence. In addition, although the species has been well collected and distributed to various herbaria for many years, it is unremarkable and has remained undescribed. This species was first collected in April 1938 (*Skutch 3765*).

Crossopetalum enervium Hammel, sp. nov. TYPE: Costa Rica. Heredia: Llanura de San Carlos, S base of Cerros Sardinal, Chilamate de Sarapiquí, 10°27′N, 84°04′W, 70–100 m, 2 June 1985 (fl, fr), *Grayum & Jacobs 5351* (holotype, CR; isotypes, F, MO, LL + 3, dist. from MO as *C. eucymosum*). Figure 4.

Differt a species affinibus foliorum nervis lateralibus inconspicuis, apprime a *C. standleyi* foliis latioribus sed brevioribus, inflorescentiis ut videtur simplicioribus, a *C. gomezii* foliis multo minoribus.

Shrubs or small trees 1–5(–8) m; twigs sharply quadrate-ribbed, glabrous. Leaves opposite, 6–10 × 1.8–4 cm, elliptic, the apex acute to acuminate, apiculate, the base acute and decurrent, distantly but sharply serrate, glabrous; main lateral veins 4–6, loop-connected well below the margin, very indistinct above and below; petioles ca. 3–5 mm; stipules minute, caducous extensions of the twig angles. Inflorescences ca. 1–1.5 cm long, mostly 3–7(–25)-flowered, usually only 1-branched, axillary to extra-axillary cymes, glabrous or rarely puberulent; bracts and bracteoles small but ± foliaceous, gland-tipped; peduncles 7–13 mm, the pedicels 1.5–3 mm. Flowers small, 4-merous; sepals ca. ½ the size of the petals, rounded; petals ca. 1–1.5 mm, ± orbicular, the usually wine-red margins slightly crenate; stamens yellow, borne from just inside the margin of a flat, circular or quadrate disc; filaments ca. 0.1–0.2 mm. Fruits drupaceous, 0.7–1.4 × 0.6–0.7 cm, obovoid, red to black; seeds tuberculate.

Additional specimens examined. COSTA RICA. **Alajuela**: Cordillera de Tilarán, Monteverde Reserve, Peñas Blancas river valley, ca. 10°20′N, 84°45′W, 800–1100 m, 22 Feb. 1989 (fl), *Bello & Cruz 724* (INB, MV), 29 Nov. 1986 (fl, fr), *Haber ex Bello 6480* (CR); Reserva Forestal de San Ramón, 800–1000 m, 4 May 1985 (fr), *E. Rojas s.n.* (USJ); Llanura de San Carlos, Pital, Yucatán, 10°34′40″N, 84°11′00″W, 100 m, 4 Oct. 1994 (fr), *Estrada 246* (INB); Llanura de Guatuso, 3 km NW of Florencia 10°23′N, 84°28′W, 250 m, 28 Dec. 1993 (fl, fr), *Haber & Guindon 11759* (CR, F, INB, LL, MO, US); 8 km NE of Villa Quesada, near Artezalea, 550 m, 17 Feb. 1966 (fr), *Molina et al. 17271* (CR, F); Pueblo Nuevo, 1100 m, 15 Apr. 1939 (fl, fr), *A. Smith 1902* (F). **Guanacaste:** Cordillera de Guanacaste, P. N. Guanacaste, Volcán Cacao, ca. 10°55′45″N, 85°28′15″W, 1100 m, 11 Feb. 1995 (fl), *Alfaro 114* (INB), 2 June 1990 (fr), *Bello 2232* (INB), 11 Apr. 1991 (fl, fr), *Chávez 543* (CR, INB), 14 July 1991 (fr), *Chávez 585* (CR, INB), 8 Feb. 1995 (fl, fr), *B. Gamboa 48* (CR, INB, MO), 10 Feb. 1995 (fl, fr), *Lobo 50* (INB), 3 June 1990 (fr), *Maas 14* (INB), 2 June 1990 (fr), *Obando 15* (CR); P. N. Rincón de La Vieja, 800 m, 27 Jan. 1983 (fl), *Garwood et al. 726* (F). **Heredia:** Llanura de San Carlos, near Tirimbina E of the Río Sarapiquí, 10°24′N, 84°07′W, 150–250 m, 12–15 Aug. 1971 (fr), *Burger & Burger 8053* (CR, F). **Puntarenas**: Cordillera de Tilarán, Monteverde area, Hoge Middle, 13 Mar. 1979 (fl), *Koptur SK-102* (CR); Cordillera de Talamanca, P. I. La Amistad, Estación Altamira, 09°02′10″N, 83°01′20″W, 1350 m, 14 Apr. 1995 (fl), *Angulo 164* (INB); Las Alturas and vicinity, 1700 m, 26 Aug. 1974 (fr), *Maas 1484* (CR, F).

Distribution. *Crossopetalum enervium* is apparently endemic to Costa Rica, where it is known from both the northern and southern parts of the country in wet to very wet forest from ca. 100 to 1700 m elevation (Fig. 2). A study of shrub and treelet species at Monteverde (Koptur et al., 1988), includes phenological data about this species (as *C. eucymosum*), vouchered by the above cited Koptur collection (Haber, pers. comm.); fruits take about 3 months to mature and then may remain on the plant up to 5 months. Most collections are from the northern half of the country in the Cordilleras de Guanacaste and Tilarán and from the Caribbean lowlands to the east. A few collections with slightly more prominent venation, approaching that of *C. standleyi*, come from an outlying population in the extreme south of the country on the Pacific slopes of the Cordillera de Talamanca very close to Panama. Although not yet known from Panama, this new species must certainly occur there.

Characterization and relationships. This species is distinctive for the very faint (when dry) lateral veins and the delicate, subumbellate inflorescences. In leaf size and certain aspects of the inflorescence and fruit, this species is most like *Crossopetalum standleyi* (Lundell) Lundell (basionym *Myginda standleyi*; *Standley 68938*, isotype, F), from which it differs by its wider and slightly shorter leaves, markedly obscure venation, and the subumbellate cymes with relatively long primary peduncles. Both *C. standleyi* and *C. enervium* have

Figure 4. *Crossopetalum enervium* Hammel. —A. Shoot with immature fruit. —B. Flowers. —C. Fruits. (A, B from *Gamboa 48*; C from *Bello 2232*.)

obovate fruits and short anther filaments. *Crossopetalum enervium* is also similar to the type of *C. riparium* (Lundell) Lundell (*Lundell 1476*, F) in its smallish leaves and delicate, glabrous inflorescences. The inflorescences of the latter species, however, are more distinctly branched, and its leaves dry brownish (rather than gray-green), and are less serrate and more prominently nerved than

those of *C. enervium*. The stamens are nearly sessile on the type of *C. riparium*. Both *C. riparium* and *C. standleyi* (originally described from Guatemala) are restricted to northern Central America. That the close relatives of this new species are from north of Costa Rica is to be expected; the genus is basically Central American and West Indian, with only one species reported from South America (Gentry, 1993). One collection of *C. enervium*, *Chávez 543*, has slightly puberulent inflorescences.

Among Costa Rican *Crossopetalum*, the new species is most similar to *C. gomezii* Lundell, which differs by having much larger leaves with very prominent venation. It has been confused with the most common Costa Rican species, formerly known as *C. eucymosum* (Loesener & Pittier) Lundell, here considered a synonym of the older *C. parviflorum* (Hemsley) Lundell:

Crossopetalum parviflorum (Hemsley) Lundell, Wrightia 3(1): 8. 1961. *Euonymus parviflorus* Hemsley, Diag. Pl. Nov. Mex. p. 6. 1878. TYPE: Nicaragua. Chontales: *R. Tate 292* (photo, US).

Crossopetalum eucymosum (Loesener & Pittier) Lundell, Wrightia 3(1): 7. 1961. Syn. nov. *Myginda eucymosa* Loesener & Pittier, Contr. U.S. Natl. Herb. 12: 175. 1909, Pl. 18. TYPE: Guatemala. Alta Verapaz: Cahabon River, *Pittier 239* (US).

Crossopetalum parviflorum has much larger, more open, pubescent inflorescences, larger flowers with longer stamens, and leaves that dry brownish instead of gray and have more obvious secondary venation. The five Costa Rican species of *Crossopetalum* can be distinguished by the following key:

1a. Leaves pubescent, mostly less than 1.5 cm wide, acute; plants from near sea level on the dry Pacific coast . . . . . *C. uragoga* (Jacquin) Kuntze
1b. Leaves glabrous, mostly more than 2 cm wide, acuminate or acute; plants from higher or at least wetter habitats.
  2a. Fruits cylindrical; leaves acute at apex, conspicuously toothed; flowers nearly sessile at the end of a short peduncle . . . . . *C. tonduzii* (Loesener) Lundell
  2b. Fruits obovoid; leaves acuminate at apex; flowers both pedicellate and pedunculate.
    3a. Inflorescence pubescent, openly cymose-branched; largest leaves mostly 10(–13) cm long, inconspicuously toothed, drying brownish; filaments nearly ½ length of petals . . *C. parviflorum*
    3b. Inflorescence glabrous (very rarely pubescent in *C. enervium*), little branched, appearing almost umbellate; leaves larger or smaller, drying gray; filaments much less than ½ length of petals.
      4a. Leaves inconspicuously toothed, the largest at least (12–)15 cm long; lateral nerves conspicuous below . . . . . *C. gomezii*
      4b. Leaves conspicuously toothed, the largest mostly 6(–7) cm long; lateral nerves very indistinct below . . . . . *C. enervium*

Etymology and history. The epithet "enervium" is chosen in reference to the inconspicuous lateral venation of the leaves in dry specimens. Here again "reconditum" was a serious contender for the honors; this rarely collected species has actually been in collections for quite long, the earliest known gathering being that of *Austin Smith 1902*, in 1939. That collection and others, including the type, were distributed as *Crossopetalum eucymosum*, wherein the new species has, until now, remained hidden.

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Paeonia (Paeoniaceae) in Xizang (Tibet)

Hong De-yuan

Laboratory of Systematic and Evolutionary Botany, Institute of Botany, Chinese Academy of Sciences, Beijing 100093, People's Republic of China

ABSTRACT. A taxonomic revision of *Paeonia* in Xizang is presented, and of the five species recognized, *P. ludlowii*, *P. sterniana*, *P. delavayi*, *P. emodi*, and *P. veitchii*, the first two are endemic. A new combination, *P. ludlowii* (Stern & Taylor) Hong, is proposed. A considerable search for *P. moutan* var. *atava* in its type locality led to the conclusion that the taxon is *P. rockii* subsp. *rockii*, a native of north-central China introduced to Xizang by Buddhist monks. Reproductive and other biological features of the woody *P. ludlowii* and *P. delavayi* are described. A key to species is given.

Xizang (Tibet), commonly called the roof or the third pole of the world, has a rather rich flora due to its diverse topographic and climatic conditions. More than 5000 species of vascular plants have been recorded in *Flora Xizangica* (Wu, 1981–1987). Five taxa of *Paeonia*, *P. delavayi* Franchet var. *delavayi* and var. *lutea* (Delavay ex Franchet) Finet & Gagnepain, *P. emodi* Wallich ex Royle, *P. sterniana* Fletcher, and *P. veitchii* Lynch, have been reported from Xizang (Pan, 1979, 1985). During the preparation of a monograph of *Paeonia*, it became apparent that the two woody taxa which were originally described from Xizang have been neglected in the Chinese literature. *Paeonia moutan* Aiton subsp. *atava* Brühl was described from Yadong in S Xizang (Brühl, 1896), whereas *P. lutea* Delavay ex Franchet var. *ludlowii* Stern & Taylor was described from Mailing County and adjacent regions in SE Xizang (Stern & Taylor, 1951, 1953). *Paeonia moutan* is a synonym of *P. suffruticosa*, a species well known in cultivation. One of the problems that needed explanation is the disjunction between the Xizang populations of *P. moutan* subsp. *atava* and the wild forms (*P. suffruticosa* subsp. *spontanea* (Rehder) S. G. Haw & L. A. Lauener) that are confined to a small area in Shaanxi, Shanxi, and Henan. The second problem involves the taxonomic rank of *P. lutea* var. *ludlowii* because, according to Stern and Taylor (1953), this taxon is distinctly different from variety *lutea*, especially in plant height, size of flowers, and number and size of follicles. To clarify these and other problems, fieldwork was conducted in S and SE Xizang from May to June in 1996.

PAEONIA MOUTAN AITON SUBSP. *ATAVA* BRÜHL

Brühl (1896) described this subspecies based on *King 549* (K), which was collected from Tibet (Chumbi, Tuk Chang, June 1884). Haw and Lauener (1990) treated the plant as *Paeonia suffruticosa* Andréanszky subsp. *atava*. The wild plants of *P. suffruticosa* subsp. *spontanea* are confined to a small area in N Henan, S Shanxi, and C Shaanxi. In fact, the whole *P. suffruticosa* complex (including *P. rockii*, *P. ostii*, and *P. qiui*) is confined to the Qinling Range and adjacent regions in North-central China, and none of its taxa has been recorded from Sichuan or Xizang. Several expeditions to Yadong County, where Chumbi is located, have been made since the early 1950s, but no *Paeonia* was found. The populations of subspecies *spontanea* and subspecies *atava* are isolated by more than 2000 air km and by the Qinghai-Xizang Plateau and the Himalayas.

During the 1996 expedition, the present author and three assistants spent considerable time in Chumbi Valley searching for *Paeonia*, but none was found. An extensive search was made in nearly every plant community in the valley to 3600 m elevation. The search was also extended to other places in Yadong County from Xiayadong at 2750 m, near the border with Bhutan and Sikkim, to Shangyadong at 3200 m. The peony is a famous flower in China, and wherever it exists in the wild, almost all the local people know its exact location. For example, during the expedition of 1995, inhabitants of NW Sichuan could point out the exact places where *P. decomposita* grew, and people in Mailing, Nyingchi, and Bomi counties in SE Xizang were also able to identify Lumaidao (God's flower). All 37 persons questioned indicated that no peony grows in the area. On the way back to Lhasa, a single plant of *P. rockii* (S. G. Haw & L. A. Lauener) T. Hong & J. J. Li was found in front of the Zhashilenbu Temple in Xigaze City. When asked about that plant, a Buddhist monk replied that it has "a very long history." *Paeonia rockii* has two

subspecies, and Brühl's figure (t. 126) fits *P. rockii* subsp. *rockii* rather well except for the flower color. The petals of *Paeonia* may change color if specimens are not dried quickly. Haw and Lauener (1990) commented on a specimen, *Gould 132* (K), from Bhutan as "having a large flower with blotched petals. It appears to be closer to [*P. suffruticosa*] subsp *rockii*, but the leaflets are quite frequently lobed, with up to ca. 5 rather blunt, shallow lobes per leaflet." They also considered this plant as a possible escape from cultivation at a lamasery, and their description fits *P. rockii* subsp *rockii* very well. On the basis of these findings, it is rather reasonable to say that "*P. moutan* subsp. *atava*" is actually *P. rockii* subsp. *rockii* introduced to Xigaze, Yadong, and nearby Bhutan by Buddhist monks from lamaseries in the Qinling Range.

Key to the Species of *Paeonia* in Xizang

1a. Shrubs; flowers yellow, rarely red-purple.
  2a. Carpels 2–4; follicles < 4 × 1.5 cm; petals usually red-blotched at base, rarely red-purple; filaments purple-red; plants < 1.5 m tall; leaf segments and lobes mostly entire . . . . . *P. delavayi*
  2b. Carpels 1, rarely 2; follicles 4.7–7 × 2–3.3 cm; petals pure yellow; filaments yellow; plants usually 1.5–3.5 m tall; leaf segments and lobes with acuminate teeth . . . *P. ludlowii*
1b. Herbs; flowers red, white, or pink.
  3a. All leaflets segmented, with segments again segmented, narrowly lanceolate to lanceolate, 3.5–10 × 0.4–1.7 cm; flowers purple-red . . . . . *P. veitchii*
  3b. Only terminal leaflets 3-segmented, lateral ones not segmented or unequally 2-segmented, narrowly oblong or oblong-lanceolate, 9–13 × 1.2–3 cm; flowers white or rarely pinkish white.
    4a. Carpels densely pubescent; flowers 3 on a stem . . . . . *P. emodi*
    4b. Carpels glabrous; flowers usually solitary . . . . . *P. sterniana*

Paeonia ludlowii (Stern & Taylor) Hong, stat. nov. Basionym: *Paeonia lutea* Delavay ex Franchet var. *ludlowii* Stern & Taylor, J. Roy. Hort. Soc. 76: 217. 1951. TYPE: China. SE Tibet [Kongbo Prov., Miling, Tsangpo Valley], *Ludlow, Sherriff & Taylor 4540* (holotype, BM).

Deciduous and caespitose shrubs, up to 3.5 m tall. Roots attenuate downward, not fusiform. Stems gray, up to 4 cm diam. Leaves biternate, glabrous on both sides, green above, pale glaucous beneath; petiole 9–15 cm long; leaflets 9, leaf blade 12–30 × 14–30 cm, lateral 3 leaflets on each side with main petiolules 2–3 cm long, terminal 3 leaflets with main petiolules 5–9 cm long; leaflets nearly sessile, 6–12 × 5–13 cm, usually 3-segmented nearly to base; segments 4–9 × 1.5–4 cm, mostly 3-lobed to middle; lobes 2–5 × 0.5–1.5 cm, entire or with 1 or 2 teeth, segments, lobes, and teeth all acuminate at apex. Flowers 3 or 4 on each shoot, axillary, 10–12 cm across; pedicels slightly curved, 5–9 cm long; bracts 4 or 5 and sepals 3 or 4, grade into one another; petals pure yellow, spreading, obovate, rounded at apex, 5–5.5 × 2.5–3.5 cm; filaments yellow, 1.1–1.5 cm long, anthers ca. 4 mm long; disc only 1 mm high, yellow, dentate; carpels mostly single, very rarely 2, glabrous; stigmas yellow. Follicles cylindrical, 4.7–7 × 2–3.3 cm. Seeds rounded, dark brown, ca. 1.3 cm diam. Flowering late May to early June.

In their description of *Paeonia lutea* var. *ludlowii*, Stern and Taylor (1951, 1953) indicated that the taxon is distinctly different from variety *lutea* and distinguished it by its long, commonly unbranched stems to 8 feet (vs. to 5 feet in var. *lutea*), larger and more open flowers, and up to 2 carpels twice as large as those of variety *lutea*. Upon the examination of plants in five populations in Mailing and Nyingchi counties, as well as five populations of variety *lutea* (= *P. delavayi*), these differences have been confirmed. As shown in Figures 1 and 2, plants of *P. ludlowii* are tall, caespitose, and with larger, pure yellow flowers, yellow filaments, acuminate leaf segments and lobes, and mostly one carpel per flower (more than 97% of the flowers examined have a single carpel and less than 3% have two). Furthermore, *P. ludlowii* produces very large follicles that contain the largest seeds in the genus. In contrast, plants of *P. delavayi* are not caespitose and have much shorter stems, acute leaf lobes and segments, more or less pendulous and smaller flowers on curved pedicels, yellow petals nearly always red-blotched at base, purple-red filaments, and 3 or 4 (rarely 2) much smaller carpels. These differences clearly support the recognition of variety *ludlowii* as a distinct species.

Paeonia ludlowii is a narrow endemic of SE Xizang, where it grows in sparse forests, woods, and thickets in Nyingchi, Mailing, and Lhunze counties at 92.4°–94.8°E and 28.4°–29.9°N. All five populations studied were small in size, and the largest was about 200 m in diameter. Except for the Quenima Village population (*Hong et al. H96020*), which had only four individuals, the other populations consisted of rather dense individuals, and the species was a dominant element in the community. Two factors may explain the compact population with a large number of individuals. First, this species has

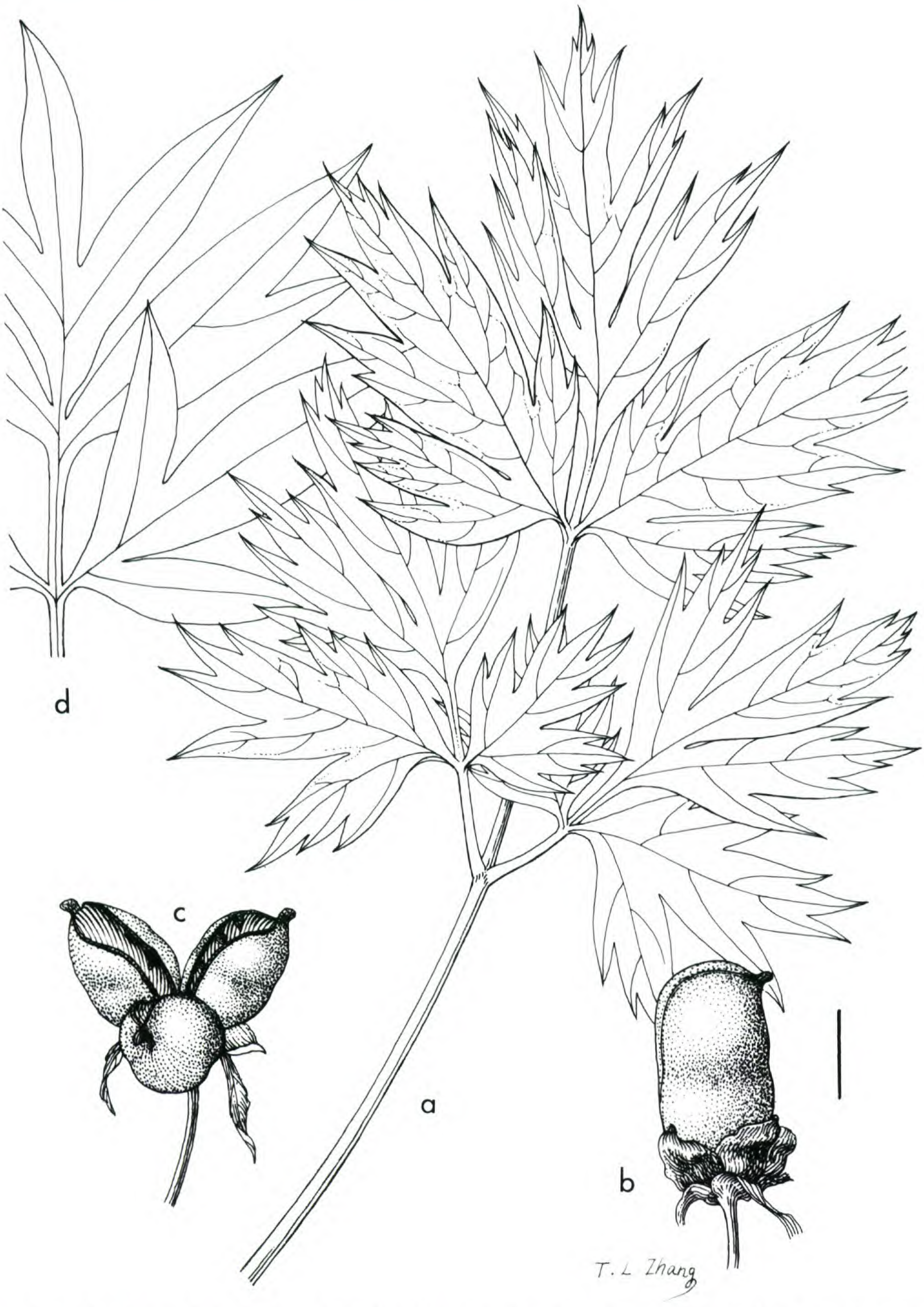

Figure 1. a, b. *Paeonia ludlowii* (Stern & Taylor) Hong. —a. Whole leaf. —b. Fruit of 1 follicle. c, d. *P. delavayi* Franchet. —c. Fruit of 3 follicles. —d. Part of leaf. Scale = 2 cm (drawn by Zhang Tai-li).

a high seed-set, and its seeds appear to have a high germination rate. Nearly 100 seedlings were found in an area of a square meter under a large individual in the Nanyigou population (*Hong et al. H96030*). Second, the seeds of *P. ludlowii* are large (ca. 1.3 cm diam.) and are not adapted to long-distance dispersal; perhaps they are mostly moved by rats. The species is obligately sexual, and no vegetatively produced individuals or plantlets have been found in any of the populations. More than 20

Figure 2. *Paeonia ludlowii* (Stern & Taylor) Hong. Clockwise from left: —A clump with dozens of stems and > 100 flowers. —Flower with yellow petals and stamens and one pistil. —Hundreds of clumps dug out for root bark medicine, thus causing a serious threat to the survival of the species.

small plantlets were dug out, and all were found to be seedlings, a sharp contrast to *P. delavayi*, which also reproduces vegetatively.

Paeonia ludlowii is a tall shrub that often forms large and dense clumps with dozens of stems. A single individual may have up to 105 flowers (Fig. 2). The species is also a medicinal plant dug out by the local people for its root bark. In three of the five populations studied (*Hong et al. H96007, H96014, H96030*), hundreds of individuals were dug out by people from Gansu and Qinghai provinces (Fig. 2). This causes a serious threat to the survival of this species. Effective measures must be taken to conserve this beautiful flower.

Paeonia ludlowii is diploid with $2n = 10$. The meiotic chromosome count, reported here for the first time, is based on *Hong, Luo & Zhang H96007* (PE).

Specimens examined. CHINA. **SE Xizang:** Mailing County: Gangga, 4 km E of Gangga Bridge, 29.3°N, 94.4°E, 2900 m, *Hong, Luo & Zhang H96005* (GH/A, K, MO, PE, S); Zhare Township, Caimu Village, N of Yarlung Zangbo (River), 29.2°N, 94.3°E, 2980 m, *Hong, Luo & Zhang H96007* (GH/A, K, MO, PE, S); between Gangga and Mailing, S of Yarlung Zangbo (River), 29.2°N, 94.2°E, 3000 m, *Hong, Luo & Zhang H96014* (GH/A, K, MO, PE, S), *Zheng 22* (Herb. Xizang Plateau Inst. Ecol. Bayi); Nanyi Township, Nanyigou (Valley), 29.2°N, 94.1°E, 2950 m, *Hong, Luo & Zhang H96030* (GH/A, K, MO, PE, S), 3300 m, *Zheng 673* (Herb. Xizang Plateau Inst. Ecol. Bayi); Regagou, 2870 m, *Xizang Inst. Ecol. 186* (Herb. Xizang Plateau Inst. Ecol. Bayi); Lhunze County: Qayu, Zuanbadala, 3450 m, *Qinghai- Xizang Expedition 750450* (PE, KUN); Nyingchi County: Bayizhen, Juemugou, 2950 m, *Yao, Tang, Zheng & Pan 1005* (Herb. Xizang Plateau Inst. Ecol. Bayi), 3000 m, *Zheng 19* (Herb. Xizang Plateau Inst. Ecol. Bayi); Dongjug Township, Quenima Village, 29.9°N, 94.8°E, 3100 m, *Hong, Luo & Zhang H96020* (GH/A, K, MO, PE, S).

Paeonia delavayi Franchet, Bull. Soc. Bot. Fr. 33: 382. 1886. TYPE: China. Yunnan: in dumetis ad juga nivalia Likiang, alt. 3500 m, 9 July 1888, *Delavay 1142* (holotype, P).

Paeonia lutea Delavay ex Franchet, Bull. Soc. Bot. Fr. 33: 382. 1886. TYPE: China. Yunnan: in calcareis montis Che-tcho-tze supra Tali, 9 May 1883, *Delavay-Paeonia 7* (holotype, P).

In addition to the differences from *Paeonia ludlowii* (see above), *P. delavayi* differs in reproducing vegetatively. All five populations studied in Nyingchi and Bomi counties were found within or near villages. In the Sumzum and Guxiang populations, plantlets both from seedlings and root turions were found, and individuals in these two populations were scattered. However, in the three populations in Nyingchi County, no seedlings were found, and all plantlets were from root turions. Individuals in these three populations were very dense and formed colonies. It appears that each of these three populations was a clone resulting from a single individual, and that they were introduced and naturalized by cloning.

Paeonia delavayi has the widest distribution of any woody species of the genus, and it grows in N Yunnan, SW Sichuan, and adjacent SE corner of Xizang.

Specimens examined. CHINA. **SE Xizang:** Zayu County: Goyu (Goqen), 3300 m, *Plant Resources Expedition of Xizang Plateau Inst. Biol. 3895* (XZ), 3100 m, *Ni, Wang, Ciduo & Cidan 1051* (PE, XZ); Zawalong, Songta Snow Mountain, 2800–3100 m, *Qinghai-Xizang Exped. 7673* (KUN); Bomi County: Sumzum Township, Sumzum, near village S of Parong Zangbo (River), 3100 m, *Hong, Luo & Zhang H96028* (GH/A, K, MO, PE, S); Guxiang Township, Gucun village, 29.9°N, 95.5°E, 2600 m, *Hong, Luo & Zhang H96024* (GH/A, K, MO, PE, S), *Ying & Hong 39, 214* (PE); between Zamu and Guxiang, 2700 m, *Zhang & Lang 379* (PE); near Bomi, valley behind army station, 2700 m, *Xiao, Xia & Mi 2233* (KUN); Nyingchi County: 0.5 km N of Nyingchi Town, W side of highway, 2950 m, *Hong, Luo & Zhang H96019* (GH/A, K, MO, PE, S); Bayi Town, Juemugou, 2950 m, *Hong, Luo & Zhang H96004* (GH/A, K, MO PE, S); Xituan Village, Genzhang Nongba (valley), on ruins of temple, 3200 m, *Hong, Luo & Zhang H96003* (GH/A, K, MO PE, S).

Paeonia sterniana Fletcher, J. Roy. Hort. Soc. 84: 326, t. 103. 1959. TYPE: China. SE Xizang: Kongbo, Tsangpo Valley, between Tripe and Gyala, 2830 m, 24 Apr. 1947, *Ludlow, Sherriff & Elliot 13543* (holotype, BM).

This species is endemic to SE Xizang.

Specimens examined. CHINA. **SE Xizang:** Zayu County: between Goyu and Cinong, 3300 m, *Qinghai-Xizang Expedition 73-294* (PE); Bomi County: Yipuxang, 3300 m, *Fei, Sun, Li & Bai 244* (KUN); Sumzum Township, S of Parong Zangbo (River), 3100 m, *Hong, Luo & Zhang H96030* (GH/A, K, MO PE, S); Sumzum Township, Mimi, 3500 m, *Ying & Hong 1097* (PE); between Bomi and Ranwu, 3500 m, *Ni, Wang, Ciduo & Cidan 133* (PE, XZ); Bomi, between Bomi and Ranwu, 3350 m, *Naito, Lang, Tateishi, Nemoto & Li 763* (PE); Ranwu to Bomi, 85 km, *Fei, Sun, Li & Bai 145* (KUN); Sumzum to Aguo, 3000 m, *Xizang Supl. Exped. Wu 5930* (KUN).

Paeonia emodi Wallich ex Royle, Ill. Bot. Himal. 57. 1834. TYPE: India. Kumaon, Shallom, *Wallich 4727* (holotype, K).

The species is widely distributed in N Pakistan, NW India, and W Nepal. It is known from a single locality in China.

Specimen examined. CHINA. **SW Xizang:** Gyirong County, Jiangcun, E slope, 2350 m, *Xizang Chinese Traditional Medicinal Plant Expedition 413* (PE).

Paeonia veitchii Lynch, Gard. Chron. Ser. 3, 46: 2, t. 1. 1909. TYPE: China. Sichuan: *Wilson Veitch Expedition 3034, 3036* (syntypes, K).

Specimens examined. CHINA. **E Xizang:** Jomda County, Gangtuo District, sunny slopes, 3100 m, 27 Aug. 1976, *Qinghai-Xizang Expedition Vegetation Group 9893* (PE).

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Charadranaetes, a New Genus of the Senecioneae (Asteraceae) from Costa Rica

John P. Janovec
Department of Biology, Texas A. & M. University, College Station, Texas, 77843, U.S.A.

Harold Robinson
Department of Botany, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560, U.S.A.

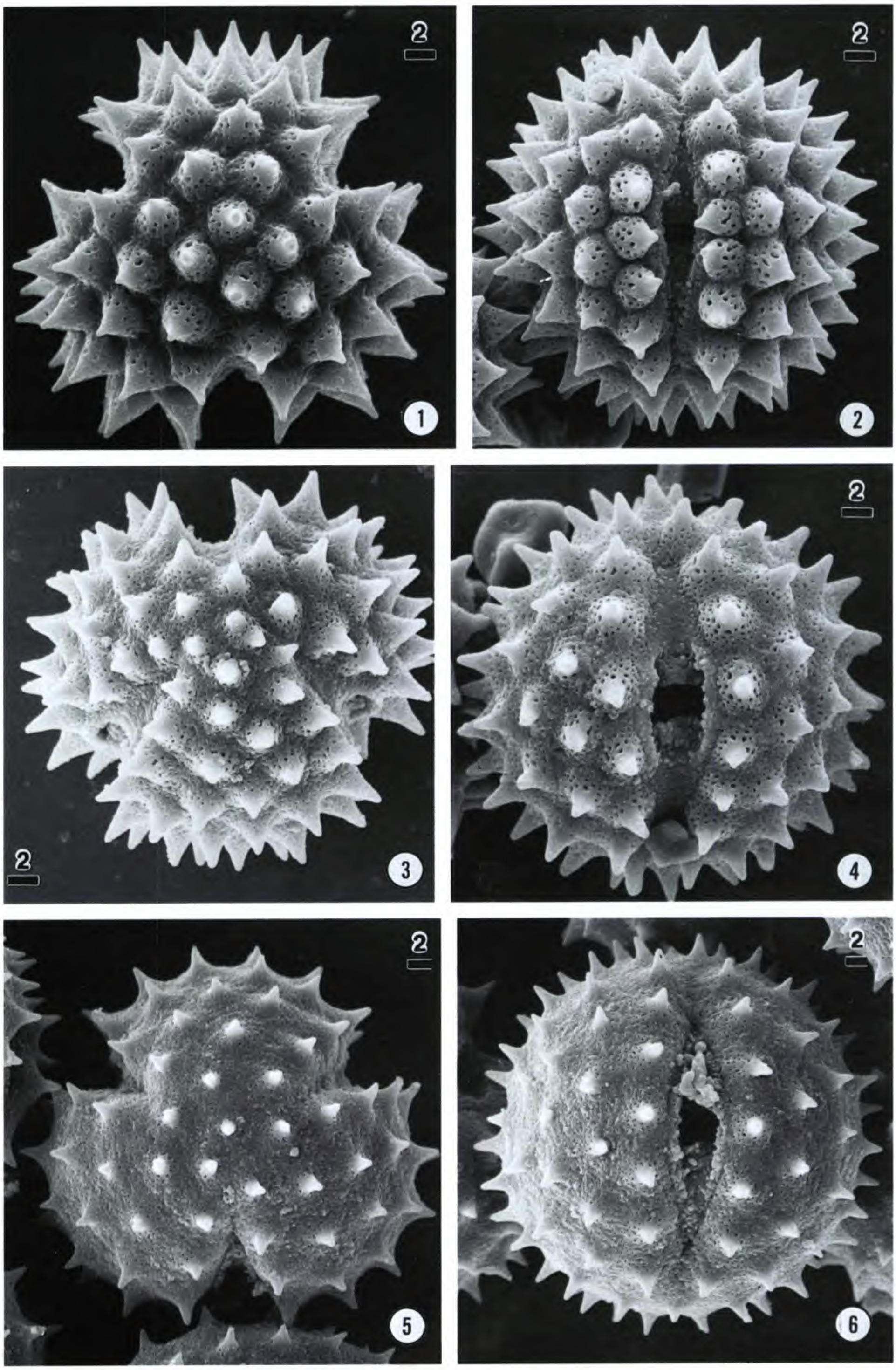
ABSTRACT. A new genus of the Senecioneae, Asteraceae, from Costa Rica, *Charadranaetes*, is described based on *Senecio durandii* Klatt, characterized by an obnoxious odor emitted by crushed parts, elongate linear corolla lobes that are not recurved, and a prominently rounded style apex that bears little or no apical coma. A key to the genera of Senecioneae in Costa Rica is furnished.

The purpose of this paper is to describe a new genus, *Charadranaetes*, based on the single species *Senecio durandii* of Costa Rica. The species was based by Klatt (1892) on a collection from near Volcán Barba in the Province of Heredia, Costa Rica. Generic position was not in question, since *Senecio* traditionally grew to include approximately 3400 species of diverse form and distribution defined by principal involucral bracts in a single series, a small but distinct calyculus, and a pappus of abundant capillary bristles. The species has since been noted as anomalous by numerous botanists but has continued by default to be included in the overly broad concept of *Senecio* because of its capillary pappus, yellow rays, and blunt style tips. The present study relies on recent progress in the understanding of the tribe Senecioneae, as reviewed below, and offers some additional evidence illustrated by scanning electron micrograph (SEM) study of pollen (Figs. 1–7) raphides of the gynoecium (Fig. 8), and number of rows of pappus bristles (Figs. 9, 10).

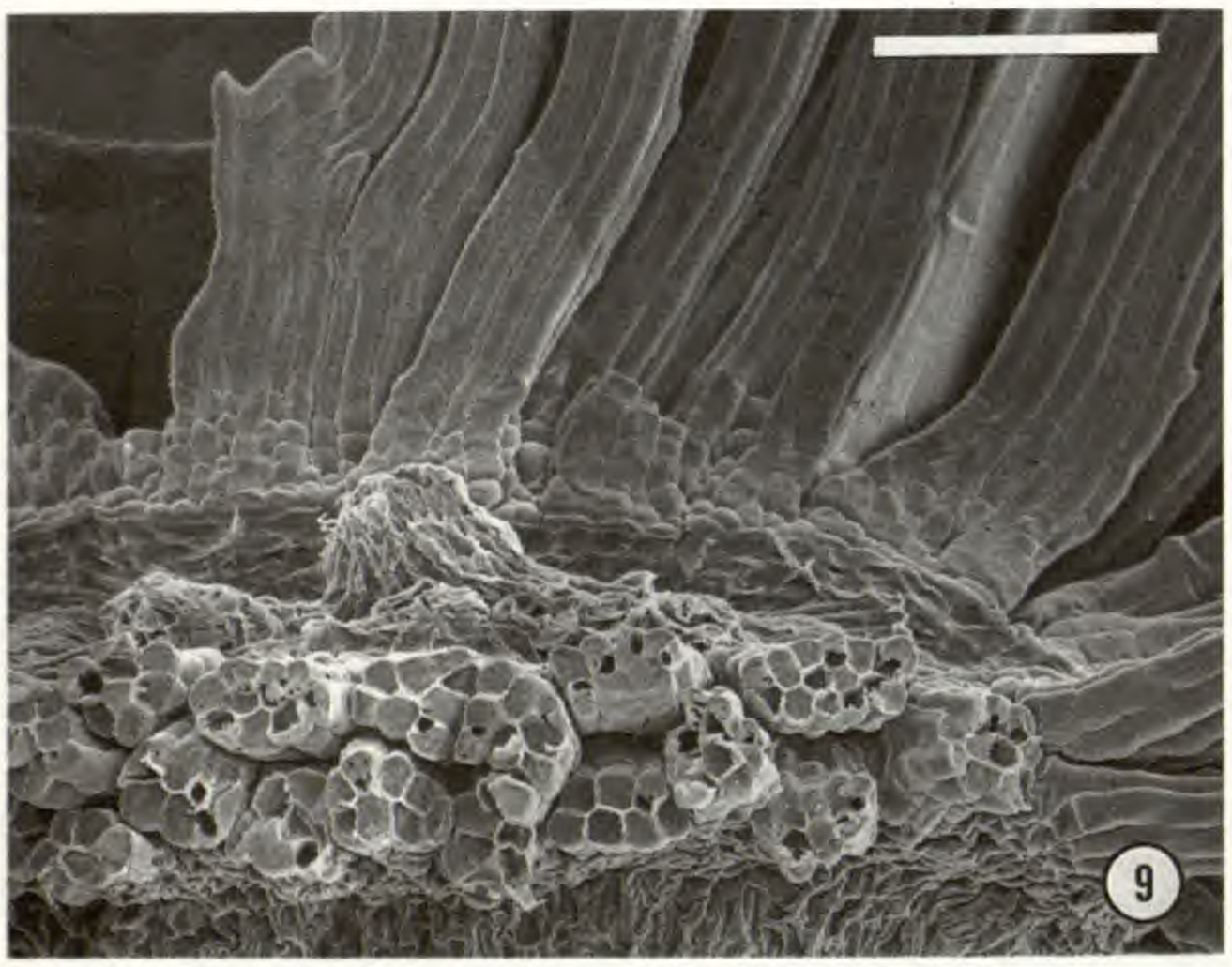
Early efforts at division of *Senecio* in North and Central America were mostly infrageneric (Greenman, 1901, 1916), and Greenman, the well-known authority in the genus, was credited by Standley (1938) with referring *S. durandii* to his section *Streptothamni*, a subgroup of vines now treated in the segregate genus *Pentacalia* (Robinson & Cuatrecasas, 1978). Standley, in his Flora of Costa Rica (1938) stated that ". . . this species is a most distinct one, altogether unlike any other with which I am familiar." He further added that *Senecio durandii* has little if anything in common with other species grouped in the section *Streptothamni* of Greenman. More recently, Barkley et al. (1996) left *S. durandii* as a species within *Senecio* sensu stricto whose accurate taxonomic disposition had yet to be ascertained.

Previous subdivisions of *Senecio* at the generic level have not included the Costa Rican *S. durandii*. It was not among the genera with pointed style tips such as *Gynoxys* Cassini or *Pseudogynoxys* (Greenman, 1916, as subgenus; Cabrera, 1950, Cuatrecasas, 1955, and Robinson & Cuatrecasas, 1977, as genus). *Senecio durandii* was not in the distinctive tussilagionoid ("cacalioid") lineage mostly of East Asia and Mexico that is distinct by cylindrical anther collars, continuous stigmatic surfaces, and a chromosome base number of $x = 30$ (Robinson & Brettell, 1973, 1974). As noted above, the Costa Rican species did not belong to the scandent or heath-like genus *Pentacalia* (Robinson & Cuatrecasas, 1978). *Dresslerothamnus* Robinson (1989) is from Panama and adjacent areas, but it differs by the scandent or scrambling habit and complex T-shaped hairs. The nearest likely relatives, *Jessea* and *Talamancalia* (Robinson & Cuatrecasas, 1994), still were not considered to include *Senecio durandii*.

The present new genus, *Charadranaetes*, cannot be included in *Senecio*, which is typified by the European native and widely adventive species *Senecio vulgaris* L. The latter species and its closest relatives are rosettiform herbs with decrescent upper foliage, fistulose receptacles, short recurved corolla lobes, and truncate style tips without an apical coma. The most typical elements of *Senecio* also have enlarged plate-like raphides in the cells of the ovule (Fig. 8). *Senecio durandii* is a semi-woody to woody, decumbent to somewhat erect subshrub with non-decrescent foliage, solid receptacles, linear and non-recurved corolla lobes, and a prominently



Figures 1–6. Scanning electron micrographs of pollen grains. 1, 2. *Senecio vulgaris, Thomas 8975* (US). —1. Polar view. —2. Colpar view. 3, 4. *Jessea multinervia, Davidse & Pohl 1577* (US). —3. Polar view. —4. Colpar view. 5, 6. *Charadranaetes durandii, Burger & Gentry 9052* (US). —5. Polar view. —6. Colpar view. Scales = 2 μm.



Figures 7–10. Scanning electron micrographs of pollen, ovule, and pappus bases. —7. *Charadranaetes durandii, Burger & Gentry 9052* (US), enlargement of colpar view showing minute perforations of tectum, scale = 2 μm. —8. *Senecio vulgaris, Thomas 8975* (US), surface of ovule showing shape of included raphides, scale = 10 μm. 9, 10. Upper callus of achenes showing bases of pappus bristles, scales = 100 μm. —9. *Charadranaetes durandii, Lent 1597* (US), showing pappus bristles in 1–2 series. —10. *Jessea cooperi, King 6832* (US), showing pappus bristles in 3–4 series.

rounded style tip with or without trace of an apical coma. The Costa Rican species and its potential relatives have only small, slender raphides in the ovules. It is a peripheral discovery of the study, that raphides of the gynoecium have not been seen in the actual achene wall of any of the many members of the Senecioneae observed in a broad survey of the tribe, only in the outer layer of the ovules. Such raphides may seem to be in the achene wall when viewing clearings of undissected achenes under the microscope or when viewing ripe achenes from which embryos have been removed.

The disk corolla lobes seem to offer the best evidence of relationship for *Charadranaetes durandii* at this time. The elongate non-recurved form is seen in three other recently described genera of the Costa Rica–Panama–Ecuador region. *Jessea* and *Talamancalia* are known mostly from Costa Rica and Panama (Robinson & Cuatrecasas, 1994), with the latter since recognized from Ecuador (Nordenstam & Pruski, 1995). The probable close relative, *Garcibarrigoa* Cuatrecasas (1986), occurs on both sides of the Río Maldonado on the border of Colombia and Ecuador. *Charadranaetes* is distinct from each of these by the lack of a well-developed apical tuft of hairs on the style tip. It differs from *Garcibarrigoa* further by the lack of a petiole base fused in a basal ring around the stem. *Talamancalia* differs by the pubescent and lobed leaves, the winged petioles, and the setuliferous achenes with obscure carpopodia. *Jessea* differs by the involucre of ca. 8(–12) bracts, the compact corymbiform inflorescence, and the large scale-like projections on the receptacle. The achene of *C. durandii* has only

1–2 rows of pappus bristles (Fig. 9), while *Jessea*, like many members of the Senecioneae, has more (3–4, Fig. 10). The achenes of *Charadranaetes* have elongate cells on their surfaces, while *Jessea*, *Talamancalia*, and *Garcibarrigoa* have short usually mamillose cells on the surfaces of their achenes.

During the study, the distinctive nature of *Charadranaetes durandii* has been reinforced by observations of the pollen. Light microscopy showed a thicker wall and smaller spines than are seen in potential relatives. SEM studies of a limited sample show that pollen in the Senecioneae, though generally uniform in type, as seen in *Senecio vulgaris* L. (Figs. 1, 2), may be worth careful study. *Charadranaetes durandii* is particularly distinct in its slight relief as though only the points of the spines were projecting (Figs. 5, 6). The exine perforations of the species are unusually small and seem scattered evenly between the points of the spines (Fig. 7). In comparison, *Jessea multivenia* has larger spines like typical *Senecio*, but it seems to have the colpi reaching closer to the poles of the grain than in other Senecioneae pollen observed (Figs. 3, 4).

Many collectors have referred to the odor of *Charadranaetes durandii*. Labels of various collections by W. C. Burger state the plants have the odor of coriander when crushed. Other collections cite the odor of *Eryngium*. The most complete description referred to the obnoxious smell of crushed stems, leaves, and inflorescence (*Almeda et al. 5791*, NY).

The new genus is named *Charadranaetes* from the Greek *Charadra*, bed of a mountain stream, and *naetes*, inhabitant.

Charadranaetes J. Janovec & H. Robinson, gen. nov. TYPE: *Senecio durandii* Klatt.

In foliis non decrescentibus non alate petiolatis non lobatis glabris inflorescentibus sparcis receptaculis nudis vel subnudis et in partibus contusis foetidis differt.

Decumbent or partially erect, semi-woody to woody, slender herbs or subshrubs, 20–60 cm tall, typically growing near margins of streams in rocky soil; stems, leaves, and inflorescence glabrous, emitting obnoxious odor when crushed; stems often purplish, losing leaves from base upward. Leaves alternate, often with base clasping but not surrounding stem; petioles slender, not winged; blade linear-lanceolate, dorsal surface paler than ventral surface, margins serrate with cartilaginous teeth, apex acuminate, secondary veins pinnate, ascending, inter-reticulation not prominent. Inflorescence terminal, with ascending branches, laxly subcorymbose to cymose, peduncles slender, elongate, glabrous, usually bearing numerous linear bracts. Heads usually 2 or 3, heterogamous, radiate, narrowly campanulate to cylindrical, with ca. 7–10 filiform calycular bracts in 1–2 series; involucral bracts usually 13 or 14, subequal, uniseriate; receptacle usually glabrous, in few plants with minute scale-like projections. Ray florets 7–11; corollas yellow to orange, glabrous, apex usually 3-toothed. Disk florets 15–28; corollas yellow, glabrous, basal tube narrow, elongate, lobes linear-lanceolate to linear, 3 times as long as wide or longer, with central and marginal resin ducts; anther collars with basal cells inflated; thecae with bases minutely sagittate or rounded, median endothecial cells with numerous thickenings on vertical walls, with few small thickenings on transverse walls; apical appendage oblong-lanceolate, narrowing toward apex; style base with distinct node; style branches with distinctly separated paired stigmatic lines or stigmatic surface with a narrow median gap, short apical appendage prominently rounded with basal fringe of hairs, without or with slight apical projection. Achenes cylindrical with 8–10 ribs, glabrous, with elongate cells on the surface; raphides restricted to ovule, elongate; carpopodium annuliform with 4–8 series of sclerified cells; pappus with slender easily deciduous bristles staggered in 1–2 series, tips acute. Pollen grains 30–40 μm diam., with short spines and minute perforations.

The genus contains the single following species.

Charadranaetes durandii (Klatt) J. Janovec & H. Robinson, comb. nov. Basionym: *Senecio durandii* Klatt, Bull. Soc. Roy. Bot. Belgique 31: 211. 1892 [1893]. *Pseudogynoxys durandii* (Klatt) B. L. Turner, Phytologia 80: 255. 1996. TYPE: Costa Rica. San José: Passage du Rio de las Vueltas (versant du Rio Sueio), 2100 m, 1888, *Pittier 220* (lectotype, selected here, BR).

Material seen. COSTA RICA. **Cartago:** El Retiro, Santa Cruz de Turrialba, 1400 m, Jan. 1941, *Valerio 1274* (F); Cerro Dean, 9°51′N, 83°46′W, 3 km E of Cachi, 9°50′N, 83°48′W, 1450 m, 23 Apr. 1969, *Lent 1597* (US); about 7 km NE of Santa Cruz on road beyond Agua, southern slopes of Volcán Turrialba, about 6400 ft., 8 Mar. 1978, *Almeda & Nakai 4170* (CAS, F, NY); Tapantí, Orosi, 1400 m, 29 Jan. 1983, *Chacón 263* (MO); along road from bridge over Río Grande de Orosi (near jct. with Río Villegas) to Río Humo, Cordillera de Talamanca, 1600–1900 m, 9°42′N, 83°47–48′W, 11 Aug. 1984, *Grayum, Jacobs & Sleeper 3746* (KSC); Refugio Nacional de Fauna Silvester Tapantí, 9°46′N, 83°48′W, along and off the switchback rock road diverging to the right just beyond the Puente Dos Amigos, 1500–1620 m, 26 Mar. 1986, *Almeda et al. 5791* (F, NY); Tapantí National Park, 9°48′18″N, 83°57′12″W, 4 Jan. 1996, *Maraga, Chavarria & Janovec s.n.* (INBio). **Heredia:** Fôrets du Rancho Flores, 2043 m, 22 Feb. 1890, *Pittier 2099* (GH); Yerba Bue-

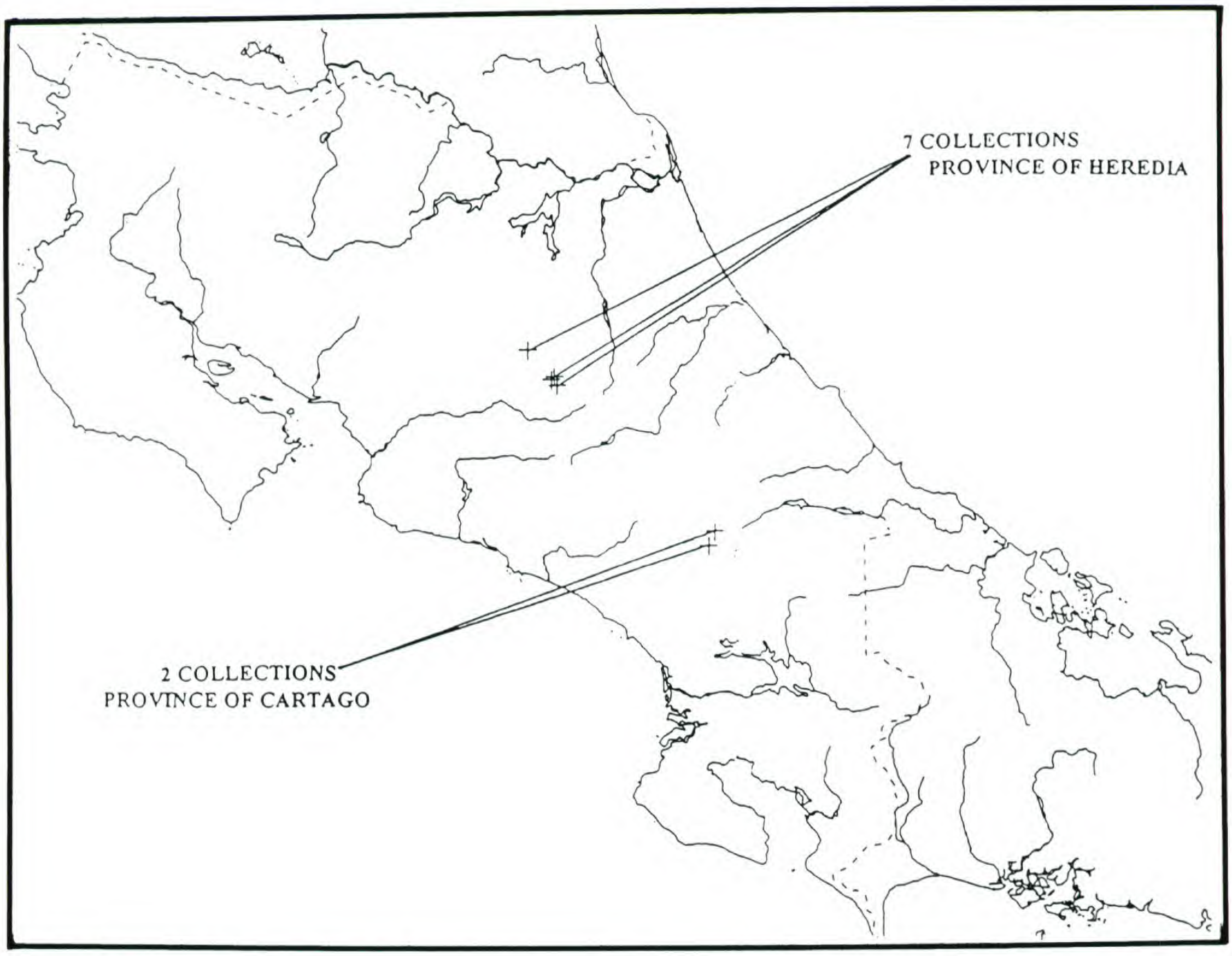


Figure 11. Distribution of *Charadranaetes durandii* in Costa Rica, based on specimens in US, showing concentrations in Cartago and Heredia.

na, NE of San Isidro, 10°02′N, 84°00′W, 2000 m, 22, 28 Feb. 1926, *Standley & Valerio 49223* (MO, US), *49798* (F, MO, US); Cerro de las Caricias, N of San Isidro, 10°04′N, 84°02′W, 2000–2400 m, 11 Mar. 1926, *Standley & Valerio 51951* (MO, US), *51973*, *52006* (US); Cerro Gallito, hasta 2000 m, 3 Feb. 1935, *Valerio 1099* (F); saddle between Volcán Barba and Volcán Irazu, headwaters of Río Patria, ca. 2220 m, 3 Feb. 1965, *Godfrey 66123a* (MO); forest of Río Vueltas, 2100 m, 23 May 1969, *Gómez 2242* (CAS, F, GH); Río Vueltas (upper Río Patria) on eastern slope of Volcán Barba on the Caribbean side of the Continental Divide, 10°14′N, 84°10′W, 1900 m, 1, 3 Apr. 1973, *Burger & J. L.Gentry 9052* (US); eastern slopes of Volcán Barba between Río Las Vueltas and Río Nuevo (upper Río Patria), 10°6′N, 84°3′W, ca. 2000 m, 25 Oct 1975, *Burger & Baker 9482* (F); border of San José and Heredia Provinces, on ridges and steep slopes along Río Para Blanca (Pacific drainage), Cerros de Zurqui, 10°3′N, 84°1′W, 1600–1800 m, 6 & 7 Feb. 1977, *Burger, Visconti & Gentry 10252* (F); south-facing slopes of Cerro Zurqui at termination of Calle Zurqui, 10°05′N, 84°01′W, 1800–2000 m, 19 Feb. 1978, *Almeda & Nakai 3692* (NY); along Río Vueltas from old road to Carillo, "Alto de Roble" above San Raphael and Uvita, 2000 m, 10°5′N, 84°5′W, 6 May 1982, *Huft & Barringer 2013* (F, MO); a la vera del Río Patria, Alto del Roble, 2000 m, 22 June 1982, *Gomez 8585* (F); pie de monte El Chompipe, 12 Feb. 1983, *Poreda & Hasbun 3417* (F).

Collections have been made in two separate areas in central Costa Rica (Fig. 11): Heredia, with drainage mostly toward the Pacific; and Cartago, with drainage toward the Atlantic. The Heredia plants have no apical coma on the styles and the groove between the stigmatic lines is weak. The Cartago material from between 9°46′ and 9°50′N is disjunct from the others, and it has a stronger separation of the stigmatic lines and a small but distinct coma on the style tip. The two types of plants may eventually prove worthy of varietal distinction. The coma in the Cartago plants of *Charadranaetes* is not nearly as large as that of the supposedly related genera, and the near or complete lack is a useful generic distinction. However, it seems likely that apical comas were plesiomorphic in the whole *Jessea–Talamancalia–Charadranaetes* clade, and that they were lost in *Charadranaetes*.

The receptacles of the Heredia collections all seem to be completely glabrous, but minute scale-like projections can be seen on the receptacles of the distinctive Cartago material.

KEY TO THE COSTA RICAN GENERA OF THE TRIBE SENECIONEAE: ASTERACEAE

1a. Stigmatic papillae continuous across at least upper third of inner surface of style branch; base of anther collar cylindrical, not inflated (tussilaginoid genera).
  2a. Stout herbs, shrubs, or small trees; stems with resin ducts in cortex; inflorescence abruptly terminating stems, subumbellate; leaves mostly clustered near ends of stems . . . . . *Telanthophora*
  2b. Stout herbs or subshrubs; stems without resin ducts in cortex; inflorescence not abruptly terminating stems, a terminal corymbose, pyramidal, or racemose panicle; leaves variously disposed . . . . . *Roldana*
1b. Stigmatic papillae divided into two distinct longitudinal lines on inner surface of style branch; anther collar balusterform, with basal cells inflated.
  3a. Vines or reclining to scandent shrubs, often epiphytic.
    4a. Style branches terminated by an acute or triangular appendage with numerous hairs prominent along margins and apex; ray corollas deep orange . . . . . *Pseudogynoxys*
  4b. Style branches papillose but not terminated by an acute or triangular appendage.
    5a. Stems, foliage, and involucral bracts bearing T-shaped or pseudostellate hairs . . . . . *Dresslerothamnus*
    5b. Stems, foliage, and involucral bracts glabrous or with simple hairs, hairs not T-shaped or pseudostellate . . . . . *Pentacalia*
3b. Plants erect or decumbent, never epiphytic.
  6a. Achenes 5-ribbed; Costa Rican species with heads homogamous.
    7a. Dense heath-like or ericoid plants of the paramos; size of stem leaves not progressively smaller upward; in Costa Rican species foliage glabrous above, somewhat glaucous or white-tomentose beneath; achenes glabrous; chromosome numbers $n = 10, 20$ . . . *Pentacalia* subg. *Microchaete* (*Scrobicaria, Monticalia*)
    7b. Somewhat succulent, weedy herbs; leaves progressively smaller; heads solitary or few in lax corymbose panicles; achenes pubescent on at least the ribs; chromosome number $n = 5$ . . . . . *Emilia*
  6b. Achenes 8–10-ribbed; heads heterogamous.
    8a. Heads disciform, with 2 or more rows of tubular-filiform, pistillate, eligulate flowers; achenes pubescent . . . . . *Erechtites*
    8b. Heads with obvious rays; achenes glabrous or pubescent.
      9a. Plants sessile rosettes; heads sessile or solitary; ecalyculate . . . . . *Werneria*
      9b. Plants caulescent; heads in branching inflorescence, calyculate.
        10a. Disk corolla lobes triangular, 2.5 times as long as wide or shorter, often recurved at anthesis . . . . . *Senecio*
        10b. Disk corolla lobes oblong-lanceolate to linear, 3 times as long as wide or longer, erect or distorted, not recurved.
          11a. Involucral bracts ca. 8(–12); inflorescences a compact corymbiform mass of numerous crowded heads; receptacle surfaces between florets with large scale-like projections . . . . . *Jessea*
          11b. Involucral bracts 13 or more; inflorescences rather lax, usually of less than 25 non-contiguous heads; receptacle surfaces between florets essentially glabrous, scale-like projections minute or lacking.
            12a. Leaves pilose to lanuginose, lobed at least near the base; petioles winged to the base; achenes pubescent; carpopodium obscure . . . . . *Talamancalia*
            12b. Leaves glabrous; margins serrate, unlobed; petioles not winged; achenes glabrous; carpopodium obvious . . . . . *Charadranaetes*

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A New Species of *Pouteria* Aublet (Sapotaceae) from Costa Rica and Colombia

Qutrico Jiménez Madrigal
Departamento de Botánica, Instituto Nacional de Biodiversidad, Apdo. 22-3100
Santo Domingo, Heredia, Costa Rica

T. D. Pennington
Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3AB, England

ABSTRACT. *Pouteria bulliformis*, a new species of tropical rainforest of Costa Rica and Colombia, is described and illustrated.

The opening of new roads, especially logging roads, into the Osa Peninsula within the last decade has been accompanied by colonization together with acceleration of the destruction of Costa Rica's most diverse tropical humid forest. However, these same roads have greatly facilitated botanical exploration, resulting in the discovery of numerous new species of trees.

Pouteria is a pantropical genus of about 350 species of trees, with about 200 species in the Neotropics (Pennington, 1990). The following description of *Pouteria bulliformis* Q. Jiménez & T. D. Pennington brings to 33 the number of species presently known from Costa Rica.

Pouteria bulliformis Q. Jiménez & T. D. Pennington, sp. nov. TYPE: Costa Rica. Puntarenas: Península de Osa, Reserva Biológica Marenco, 8°40′40″N, 83°41′00″W, 100 m, 16–20 Feb. 1988 (fl), *Q. Jiménez et al. 552* (holotype, INB; isotype, K). Figure 1.

Ex affinitate *P. simulantis* Monachino surculis et inflorescentiis tomentosis; foliis minoribus, bullatis, apice rotundato, aliquando brevissimo cuspidato, nervis tomentosis praecipue differt.

Trees 15–30 m tall, with dense crown of spreading or occasionally pendulous branches. Trunk 30–45 cm DBH, generally cylindrical, with small buttresses up to 1 m high and 50 cm radially. Bark brown or reddish brown, exfoliating in rectangular plates up to 25 × 10 cm; inner bark white. Young branches densely ferruginous-tomentose. Petiole 1.7–3 cm long, channeled above, ferruginous-tomentose. Leaf blades dark green adaxially, pale green abaxially, 15–33 × 9–16 cm, broadly elliptic to elliptic-oblong or obovate, chartaceous, bullate, ferruginous-tomentose below, especially on the veins, rounded apically and sometimes shortly cuspidate, rounded basally; margins entire; venation ± brochidodromous, midrib sunken adaxially, very prominent abaxially, secondary veins 14–23 pairs, parallel, straight or slightly arcuate, sunken adaxially, prominently abaxially, tertiary veins oblique, quaternaries reticulate. Inflorescences axillary, fascicles 2–8-flowered. Pedicels 4–21 mm long, densely ferruginous-tomentose. Sepals 5, ± free, imbricate, 4–4.5 mm long, ovate, rounded apically, pubescent without, glabrous within. Corolla cyathiform; tube ca. 3 mm long; lobes 5, imbricate, 3–3.5 mm long, broadly ovate, rounded apically, glabrous. Stamens 5; free portion of filaments ca. 0.75 mm long, anthers 2–2.5 mm long. Staminodes 5, alternating with the stamens, 2.5–3 mm long, lanceolate. Disk absent. Ovary conical, densely pubescent, 2-locular, locules uniovulate. Style ca. 1.5 mm long, glabrous, included. Fruit 4–4.2 × 3 cm, ellipsoid, obtuse to acute apically, rounded to truncate basally, sepals persistent, pubescent. Seeds ca. 3 cm long with an adaxial scar ca. 1 mm wide.

Distribution. *Pouteria bulliformis* is known by just a few collections from Costa Rica and Colombia. In Costa Rica it occurs in both the Pacific and Atlantic drainages. On the Pacific slope it is known only from the Osa Peninsula, while on the Atlantic it is known from coastal lowlands near Limón and from the Llanuras de San Carlos. The new species occurs in the Tropical Wet Forest and Tropical Wet Premontane Transition of the Holdridge system (Tosi, 1969), in a tropical rainforest type of vegetation (Gómez, 1986) with a hot, wet climate (Herrera, 1986). It is usually found on hilly, well-drained areas of primary forest. On the Osa Peninsula it grows in association with *Humiriastrum diguense* Cuatrecasas, *Brosimum utile* (Kunth) Oken, and *Vochysia ferruginea* Martius.

Paratypes. COSTA RICA. **Puntarenas**: Península de

Figure 1. *Pouteria bulliformis* Q. Jiménez & T. D. Pennington. —A. Habit. —B. Flower. —C. Longitudinal section of flower. —D. Stamen. —E. Staminode. —F. Fruit. A, F: ×0.63. B, C, D, E: ×3.6.

Osa, Parque Nacional Corcovado, Estación Los Patos, Cerro Degra, 08°34′00″N, 83°31′00″W, 7 Sep. 1993, *R. Aguilar 2269* (CR, INB, MO); Península de Osa, Parque Nacional Corcovado, Estación San Pedrillo, sendero a río Pargo, 08°37′00″N, 83°44′00″W, 13 Sep. 1993, *R. Aguilar 2294* (CR, INB, MO); Península de Osa, Estación Biológica Marenco, 08°41′N, 83°42′W, 16–20 Feb. 1988, *W. Burger et al. 12372* (CR, F); Península de Osa, Rincón, Aguabuena, cuenca media de Quebrada El Campo, 08°42′35″N, 83°31′50″W, 3 Oct. 1990, *G. Herrera 4458* (CR, INB, MO); Península de Osa, Rancho Quemado, 08°41′N, 83°34′W, 28 Mar. 1989, *Q. Jiménez & B. Jaén 682* (CR, INB, MO). **Limón:** Parque Recreativo Portete, 16 July 1982, *P. E. Sánchez 120* (CR); Parque Recreativo Portete, 31 Jan. 1984, *T. D. Pennington & L. J. Poveda 11453* (CR). **Heredia:** Sarapiquí, Cuatro Esquinas (entrando por Pital de San Carlos), Finca La Marinita, 18 Nov. 1983, *L. J. Poveda et al. 3719* (CR). COLOMBIA. **Chocó:** Mun. Quibdó, Quibdó–Yutó, Río Cabi, 7 Apr. 1984, *F. García Cossio 66* (K, MO). **Valle:** Bajo Calima, Concesión Pulpapel/Buenaventura, 12 Dec. 1984, *M. Monsalve 601* (K).

Vernacular name: Chanó (Chocó).

Pouteria bulliformis belongs in the large (ca. 63 spp.) section *Franchetella* (Pierre) Eyma. It is most similar to *P. simulans* Monachino (Panama, Venezuela, and Peru), which has similar flowers and fruits but differs in leaf morphology, as summarized below.

Pouteria simulans: Young shoots and inflorescences short-pubescent; leaves 2–3 times as long as broad, narrowly short-attenuate apically, plane, more or less glabrous.

Pouteria bulliformis: Young shoots and inflorescences tomentose, most leaves less than twice as long as broad, rounded apically, sometimes short cuspidate, bullate, tomentose at least on the veins.

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American *Cynanchum* (Asclepiadaceae)—A Preliminary Infrageneric Classification

Sigrid Liede
Abteilung Spezielle Botanik, Universität Ulm, 89069 Ulm, Germany

ABSTRACT. A subdivision of American *Cynanchum* at the sectional level is suggested and is understood to comprise the following: *C.* sect. *Cynanchum* (also found in the Old World), *C.* sect. *Formosum*, *C.* sect. *Macbridea*, *C.* sect. *Microphyllum*, *C.* sect. *Telminostelma*, *C.* sect. *Roulinia*, and *C.* sect. *Mellichampia*. The identity of *Dicarpophora* is clarified and the position of *Telminostelma* is discussed. Four new combinations are proposed: *Cynanchum mazzuchii* (Spegazzini) Liede, *Cynanchum brasiliense* (Morillo) Liede, *Cynanchum gentryi* (Morillo) Liede, and *Cynanchum gilbertii* Liede (replaces *Metalepis prevostiae* Morillo). *Orthosia* is recognized as distinct from *Cynanchum*. A checklist of species and their sectional affinities is given and poorly understood taxa are highlighted.

The large genus *Cynanchum* (ca. 400 species) is distributed worldwide, with centers of distribution in Madagascar, southern China, and the northeastern Andes. Following the exclusion of *Vincetoxicum* Wolf, the ca. 150 Old World species of the genus, though highly diverse in many characters, form a well delimited group and can be accommodated in two sections (Liede, 1996). Here, species delimitation is usually easy, and most species, except for some Madagascan endemics, are relatively widespread and frequent.

In contrast, the New World species are taxonomically extremely difficult: most of them constitute narrow endemics; species delimitation is difficult because characters are rather cryptic; and Woodson (1941), based only on North American material, united morphologically distinct taxa with *Cynanchum*, especially the equally diverse and difficult genus *Metastelma*. Numerous workers have described new species galore without following any clearcut concept of the genus. In a previous paper, Liede and Meve (1997) attempted to exclude obvious misfits from *Cynanchum*; the present paper provides a framework against which future descriptions can be compared, so that, in the end, a complete revision of the American members of the genus will be possible.

So far, only one group of American species has been treated at this level, *Cynanchum* subg. *Mellichampia* Sundell (Sundell, 1981). Sundell (1981) described four sections in this subgenus, two of which, sect. *Roulinia* (Decaisne) Sundell and sect. *Mellichampia* (A. Gray ex S. Watson) Sundell, are well delimited and are almost certainly "true" members of *Cynanchum*. The position of the monotypic section *Ampelamus* (Rafinesque) Sundell cannot be ascertained at present. Its only member, *C. laeve* (Michaux) Persoon, deviates from all other members of the genus by its entirely free corona lobes and clear latex. Because a comparison of morphological characters alone is insufficient to determine the position of this aberrant taxon, I am arguing for the conservative view not to change its current placement (Sundell, 1981), even though a re-establishment of the genus *Ampelamus* Rafinesque to me would seem the more adequate expression for its status. The fourth section, *Metalepis* (Grisebach) Sundell, deserves a more thorough discussion (see below).

During my seven years of study of the genus *Cynanchum*, the question of delimitation of natural groups in the New World has taken a major part of my efforts. While some of the herbaria holding type material proved remarkably unresponsive to my repeated requests for material, nevertheless I have been able to study most species consulting original material. Drawings showing detailed floral structure were available for a few species only and have been used to determine the position of a species if no original material could be borrowed. Although my studies are incomplete, I am able to provide an annotated checklist-type survey of the New World *Cynanchum*, so that future researchers will find a useful framework for their studies. Because I am hesitant as to the relationships between the groups delimited here, sectional rank is attributed to all of them. Known heterotypic synonymy is indicated; however, gradually increasing collections are likely to expose still more taxa as merely representative of the extremes of a gradient. To account for the preliminary character of this paper, the number of new combinations has been kept as low as

possible. In particular, the new combinations resulting from *Orthosia* (incl. *Amphistelma*) considered as a genus well distinct from *Cynanchum* have not been carried through, awaiting an in-depth revision.

Materials and Methods

More than 500 specimens from the holdings of AAU, B, BM, CTES, G, GA, GB, L, LIL, LPB, M, MO, MPU, P, S, SGO, SI, UC, and USZ have been studied. Dried material was supplemented by my own collections of living and spirit material from Argentina, Bolivia, Chile, Mexico, and the United States.

Key to the Sections of *Cynanchum* and Frequently Confused Genera in the New World

1. Leaves ovate, at least 5 cm long, with cordate to deeply cordate leaf bases 2
1′. Leaves either linear or ovate, if ovate, then much smaller than 5 cm (except *C. goertsianum* and *C. morrenioides*), leaf bases not deeply cordate 5
2. Stipule-like leaflets absent, inflorescences axillary, complex, dichasial, follicles, as far as known, ovoid-fusiform, thick-walled (one per flower) . . . . . *C.* sect. *Telminostelma*
2′. Stipule-like leaflets regularly present, inflorescences "extra-axillary," simple, dichasial or bostrychoid, follicles, as far as known, fusiform or elongated, thin-walled (one or two per flower) 3
3. Plants regularly forming two follicles per flower, follicles elongated, three-angled in cross section, inflorescences dichasial, corona highly connate . . . . . *C.* sect. *Formosum*
3′. Plants only occasionally forming two follicles per flower, follicles fusiform, circular in cross section, inflorescences bostrychoid, corona connate for not more than ½ of its length 4
4. Stems and leaves softly pubescent, corollas small, greenish or whitish, stylar heads papillate (except *C. ligulatum*) . . . . . *C.* sect. *Mellichampia*
4′. Stems and leaves glabrous, corollas large, purplish, stylar heads flat, depressed . . . . . *C.* sect. *Roulinia*
5. Corolla bearded, corona of five staminal lobes not laterally fused 6
5′. Corolla glabrous or with trichomes, but not bearded, corona of staminal parts fused for at least ¼ of corona length 7
6. Staminal corona parts simple . . . . . *Metastelma*
6′. Staminal corona parts with an adaxial ligule (sometimes rather small) . . . . . *Ditassa*
7. Follicles regularly two per flower, narrowly oblong; inflorescences frequently axillary, staminal parts of the corona frequently tridentate with prominent median tooth 8
7′. Follicles regularly one per flower, fusiform, inflorescences extra-axillary, staminal parts of the corona not tridentate 9
8. Inflorescences complex, bostrychoid, corona highly connate, or frequently with a ring of fused staminal and interstaminal parts in addition to free staminal parts . . . . . *Tassadia*
8′. Inflorescences simple, sciadioidal, corona basally connate, free staminal parts never present . . . . . *Orthosia*
9. Branching pattern at least basally distinctly dichasial . . . . . *C.* sect. *Microphyllum*
9′. Branching pattern monochasial 10
10. Leaves ovate, corona highly connate . . . . . *C.* sect. *Cynanchum*
10′. Leaves linear, corona connate for ⅓ of its length or absent . . . . . *C.* sect. *Macbridea*

Annotated Checklist (Compare Table 1)

Cynanchum sect. **Cynanchum**

A number of species, particularly from southern South America, do not display any characters differentiating them from the smaller members of the genus in South Africa. As those are attributed to the typical section, their South American counterparts should also be included there.

Small (usually less than1 m tall, with exception of *C. goertsianum* Morillo), predominantly herbaceous twiners, more rarely shrublets with or without twining apical shoots, leaves small (less than 5 cm long, often not exceeding 1 cm, with exception of *C. goertisanum* Morillo), leaf bases only slightly cordate, more frequently rounded or acute, inflorescences extra-axillary, the corolla lobes adaxially either glabrous or with widely spaced, conical, verrucose trichomes, corona consisting of highly fused staminal and interstaminal parts; follicles one per flower, obclavate; seeds usually ovate, winged, smooth or sculptured.

With the exception of the Brazilian *C. morrenioides*, which bears a strong resemblance to some Madagascan species with its strongly centrifugal anther wings and the main corona lobes opposite the corolla lobes (compare, e.g., *C. danguyanum* Choux), and the aberrant *C. goertsianum* from the Guianas, all species originate from southern Argentina and Chile.

C. acutifolium (Philippi) Reiche
C. boerhavifolium Hooker & Arnott
C. bulligerum (Spegazzini) Macloskie
C. descolei T. Meyer
C. diemii T. Meyer
C. goertsianum Morillo
C. hickenii Malme
C. lancifolium Hooker & Arnott (incl. *Cynoctonum nemorosum* Philippi)
C. morrenioides Goyder
C. myrtifolium Hooker & Arnott
C. nummulariaefolium Hooker & Arnott (incl. *C. mucronatum* (Decaisne) Reiche, *C. chilense* (Philippi) Malme, *C. nanum* Skottsberg)

Table 1. American *Cynanchum* and genera confused with it.

	Cynanchum sect. *Cynanchum* (New World)	*Cynanchum* sect. *Formosum*	*Cynanchum* sect. *Macbridea*	*Cynanchum* sect. *Mellichampia* sensu Sundell (1981)	*Cynanchum* sect. *Microphyllum*
Branching pattern	monochasial	monochasial	monochasial	monochasial	dichasial
Adventitious buds	absent	absent	absent	absent	present
Shoots	basally woody, herbaceous	basally woody, herbaceous	green	basally woody, herbaceous	green, ridged
Stipules	absent	present	absent	present	absent
Leaf arrangement	decussate	decussate	decussate	decussate	distichous
Leaf shape	ovate	ovate	linear	ovate	ovate
Leaf bases	obtuse	deeply cordate	acute to acuminate	deeply cordate	rounded to slightly cordate
Inflorescence position	extra-axillary	extra-axillary	extra-axillary	extra-axillary	extra-axillary
Inflorescence structure	simple, bostrychoid	simple, dichasial	simple, sciadioidal	simple, bostrychoid	simple, sciadioidal
Petal length	2–4 mm	6–8 mm	5 mm	5–10 mm	4 mm
Corolla, adaxially	glabrous or with sparse verrucose trichomes	glabrous	glabrous or with short trichomes	glabrous or with short trichomes	glabrous or with short trichomes
Corona	C(is), highly connate	C(is), highly connate	C(is), connate for ca. ⅓ or absent	C(is), connate for ca. ⅓ of length	C(is), basally connate
Follicles per flower	1	2	1	1	1
Follicle shape	fusiform, ± circular in cross section	elongated, three-angled in cross section	fusiform, ± circular in cross section	fusiform, ± circular in cross section	fusiform, ± circular in cross section
Seed shape and structure	ovate; smooth/tuberculate winged or wingless	ovate; smooth, winged	ovate; smooth/tuberculate	ovate; tuberculate, winged or wingless	ovate; smooth

C. pachyphyllum (Decaisne) K. Schumann
C. patagonicum (Philippi) Malme
C. undulatum (Decaisne) K. Schumann
C. viride (Philippi) Reiche

Cynanchum sect. **Formosum** Liede, sect. nov. TYPE: *Cynanchum formosum* N. E. Brown, Kew Bull. 1895: 112. 1895.

Dicarpophora Spegazzini, Physis (Buenos Aires) 8: 269. 1926. TYPE: *Dicarpophora mazzuchii* Spegazzini.

Lianae foliis alte cordatis, inflorescentiis extra-axillaribus, multifloris, partibus coronae staminalibus interstaminalibusque late connatis, folliculis duplicibus, oblongiformibus, triangularibus in diametro.

Plants large twiners (5 m tall or taller), leaves ovate, basally deeply cordate, with "stipules"; inflorescences constituting richly branched bostrychoid cymes, flowers large (to 1 cm diam.), corolla lobes glabrous, corona consisting of highly fused staminal and interstaminal parts, overtopping the gynostegium, follicles always two per flower, three-angled, seeds smooth, winged. This small but conspicuous group of species is restricted to the Andes of Ecuador and Peru.

Table 1. Continued.

Cynanchum sect. *Roulinia* sensu Sundell (1981)	*Cynanchum* sect. *Telminostelma*	*Ditassa*	*Metastelma*	*Orthosia*	*Tassadia*
monochasial	monochasial	monochasial	monochasial	dichasial	monochasial
absent	absent	absent	absent	absent	absent
basally woody, herbaceous	basally woody, herbaceous	wiry, brown	wiry, brown	green, ridged	brown, woody
present	absent	absent	absent	absent	absent
decussate	decussate	decussate	decussate	decussate or distichous	decussate or distichous
ovate	ovate	ovate to obovate	ovate to obovate	ovate, linear or absent	ovate
deeply cordate	cordate to deeply cordate	obtuse or acute	obtuse	rounded	rounded
extra-axillary	axillary	extra-axillary	extra-axillary	extra-axillary–axillary	extra-axillary–axillary
simple, bostrychoid	complex, dichasial	simple, sciadioidal	simple, sciadioidal	simple, sciadioidal	complex, bostrychoid
4–7 mm	1.5–3 mm length ≥ width	1–4 mm	1–4 mm	1–2 mm	2–3 mm
sparse or with short and long trichomes in the sinus	with short trichomes	bearded, rarely glabrous	bearded, rarely glabrous	glabrous	glabrous or with short and long trichomes
C(is), connate for ca. ⅓ of length	C(is), highly connate, often Ci dominant	double Cs	simple Cs	C(is), basally connate	C(is), highly connate, or C(is) + Cs
1	1	2	2	2	2
fusiform, ± circular in cross-section	ovoid-fusiform, thick, ± circular in cross-section	fusiform	fusiform, ±circular in cross-section	elongated, ±circular in cross-section	elongated, ±circular in cross-section, with basal hump
ovate; tuberculate, winged or wingless	?????	ovate; smooth, winged	ovate; smooth, winged	cymbiform; smooth or tuberculate, wingless or apically winged	cymbiform; smooth or tuberculate, wingless or apically winged

Cynanchum mazzuchii (Spegazzini) Liede, comb. nov. Basionym: *Dicarpophora mazzuchii* Spegazzini, Physis (Buenos Aires) 8: 270. 1926. TYPE: Bolivia. Tupiza: Cult. in horto Domini O. Reyes, Mar. et May 1926, *Mazzuchi s.n.* (lectotype, designated here, photograph Physis 8: 271. 1926).

The type specimen of the monotypic genus *Dicarpophora* has not been traced, despite an intense search in LP and LPS, where Spegazzini's material is usually kept. B also does not possess a specimen. Correspondence between J. Fontella Pereira and E. de la Sota indicates that the specimen has been missing at least since 1983. However, the photograph of the type accompanying the original diagnosis shows all the typical features of a plant of the *C. formosum* affinity. The type collection originates from a garden in Bolivia; no other material of this section has been found in Bolivia. However, I have found *C. formosum* in the vicinity of a garden in Chile (*Liede & Conrad 3061*, MSUN, ULM), and it has probably been more widely cultivated because of its showy, sweetly scented flowers. While it is therefore very likely that *C. mazzuchii* is a synonym

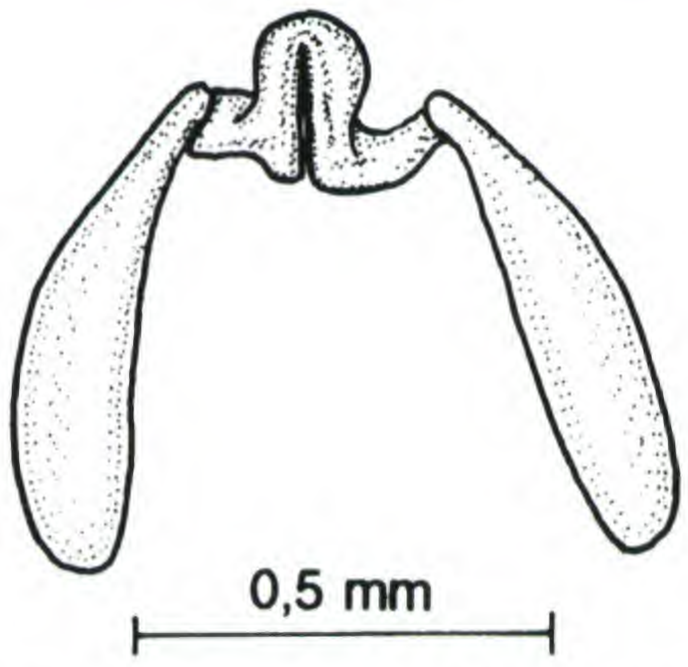

Figure 1. *Cynanchum tarmense* Schlechter. Pollinarium (from *Becker & Terrones 223*, USZ, drawn by U. Meve).

of *C. formosum*, the photograph of the type is insufficient to determine details of flower structure and confirm this suspicion.

C. canoi Morillo

C. formosum N. E. Brown (incl. *C. ecuadorense* Schlechter, *C. eurystephanum* Malme)

C. longirostrum (K. Schumann) W. D. Stevens

C. tarmense Schlechter (Fig. 1)

C. tiaratum Malme

Cynanchum sect. **Macbridea** (Rafinesque) Liede, sect. et stat. nov. Basionym: *Macbridea* Rafinesque, Amer. Monthly Mag. & Crit. Rev. 3: 99. 1818. TYPE: *M. maritima* (Elliott) Rafinesque.

Seutera Reichenbach, Consp. Regn. Veg. 131. 1828. Nom. illeg. for *Lyonia* Elliott, Sketch Bot. S. Carolina 1: 316. 1817. Nom. rej.

Pattalias S. Watson, Proc. Amer. Acad. Arts 24: 60. 1889. TYPE: *Pattalias palmeri* S. Watson.

Tylodontia Grisebach, Cat. Pl. Cub. 175. 1866. TYPE: *Tylodontia cubensis* Grisebach, Cat. Pl. Cub. 175, nom. nov. for *Astephanus grisebachii* M. Gomez, Perianth 276. 1894.

Plants herbaceous, twining, leaves lanceolate to linear, inflorescences extra-axillary, sciadioidal, corolla abaxially glabrous, corona absent or consisting of basally fused staminal and interstaminal parts, with only staminal lobes differentiated, but these exceeding the gynostegium, anther wings centrifugal, stylar head conical, fruits single, fusiform, seeds winged or wingless, smooth or, more frequently, sculptured with tubercles.

As pointed out before (Liede & Meve, 1997), this small section, which is restricted to North America and the Caribbean, cannot be included in *Metastelma*, even though it shares with *Metastelma* the linear leaf shape and the extra-axillary sciadioidal inflorescences. However, the species in which the corona is not entirely absent possess the defining character for *Cynanchum*, a corona of fused staminal and interstaminal parts, and all species lack the most reliable character of *Metastelma*, the bearded corolla lobes.

C. angustifolium Persoon

C. grisebachii (M. Gomez) Woodson

C. mulegensis Wiggins

C. palmeri (S. Watson) S. F. Blake

C. peninsulare S. F. Blake

C. utahense (Engelmann) Woodson

C. wrightianum Alain (nom. nov. for *Astephanus urceolatus* Grisebach)

Cynanchum sect. **Microphyllum** Liede, sect. nov. TYPE: *Cynanchum microphyllum* Kunth, in Humboldt & Bonpland, Nov. Gen. Sp. Pl. 3: 204, t. 236. 1818. TYPE: Ecuador. Prope Pasto, Nov, *Bonpland s.n.* (holotype, P).

Lianae herbaceae, dichasiale ramificantes, saepe gemmis adventitiis, inflorescentiis extra-axillaribus, floribus minutibus, partibus coronae staminalibus interstaminalibus breve connatis, folliculis singulis, obclavatis.

Plants with a pronouncedly dichasial branching pattern, frequently with adventitious branches and ridged, green shoots. Leaves small (normally not exceeding 1 cm length), shortly petiolate, basally obtuse or very slightly cordate, inflorescences extra-axillary, mostly sciadioidal, corolla lobes mostly glabrous, rarely with verrucose trichomes (*C. luteynii*), corona of connate staminal and interstaminal parts, only staminal parts differentiated, gynostegium sessile or stipitate, fruits single, obclavate, seeds rather elongate, slightly sculptured.

The delimitation of this difficult section against *Orthosia* is not yet fully understood, as both groups share a dichasial branching pattern, the frequent occurrence of ridged green stems, and an often distichous arrangement of leaves. However, *Orthosia* possesses two characteristic narrowly oblong fruits containing cymbiform seeds, a combination characterizing *Tassadia*, while section *Microphyllum* shares with most other sections of *Cynanchum* a single fusiform follicle containing ovate seeds. Also, inflorescences in *Orthosia*, as in *Tassadia*, are predominantly secondarily axillary (see Liede & Weberling, 1995) while those in section *Microphyllum*, like in most sections of *Cynanchum*, are strictly extra-axillary. Description of inflorescence position has been frequently found to be incorrect in the protologues and needs careful reassessment.

In Ecuador, two members of section *Microphyllum*, *C. brachyphyllum* (with stipitate gynostegium) and *C. velutinum* (with sessile gynostegium), display a dense yellowish indumentum on all vegetative plant parts, a very rare character in the *Cy-*

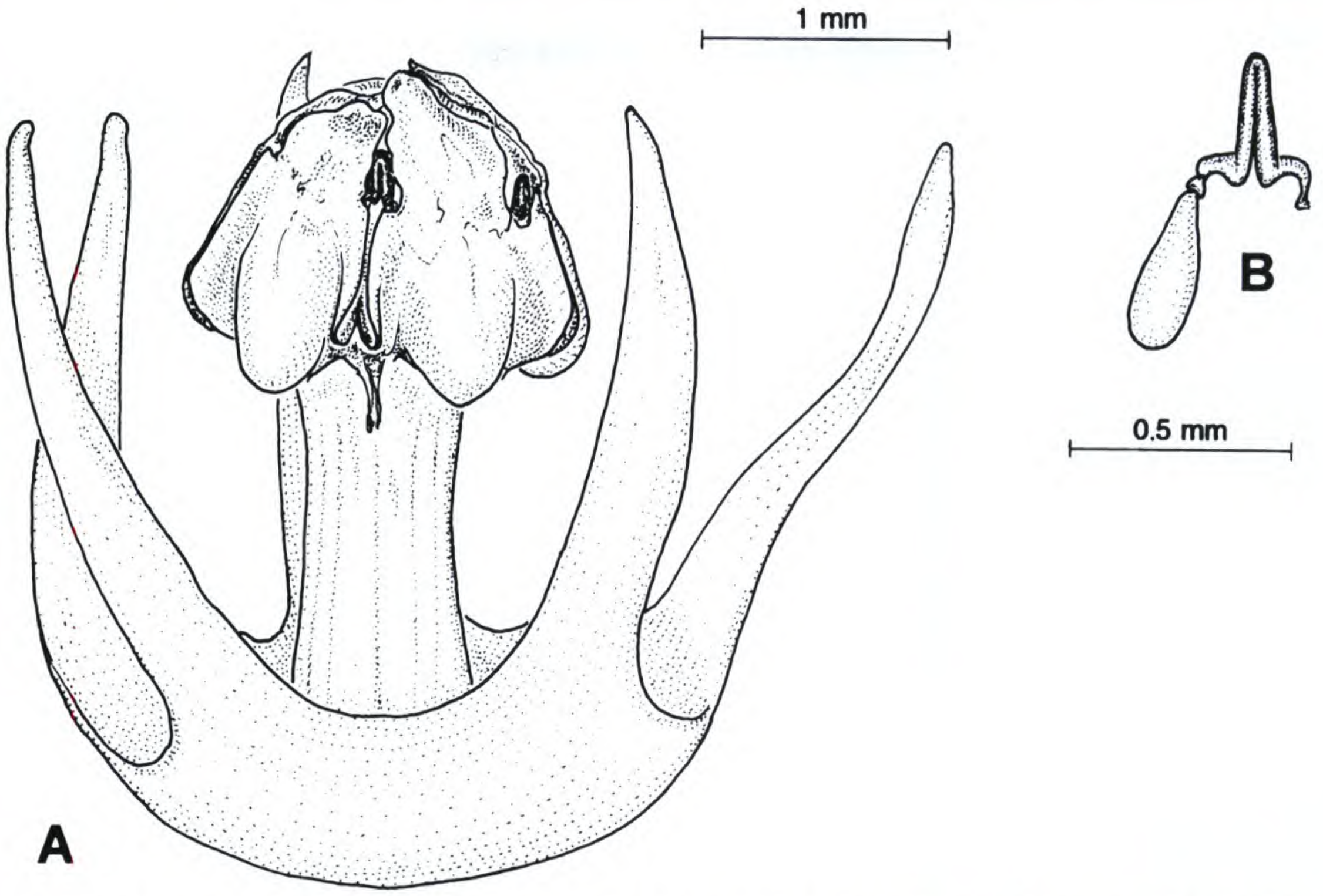

Figure 2. *Cynanchum brachyphyllum* K. Schumann. —A. Corona with gynostegium. —B. Pollinarium. (From *Sodiro 107/12*, G, drawn by U. Meve.)

nanchum alliance. All species of this section, except for *C. filisepalum* from Costa Rica, live in the Ecuadorian, Peruvian, and Colombian Andes, and, as far as known, at altitudes between 3000 and 4000 m.

C. bifidum Liede & Meve
C. brachyphyllum K. Schumann (Fig. 2)
C. chimboracence Morillo
C. filisepalum (Standley) L. O. Williams
C. intricatum K. Schumann
C. longecalicinum Morillo
C. luteynii Morillo
C. microphyllum Kunth
C. veleziae Morillo
C. velutinum Morillo

Cynanchum sect. **Telminostelma** (E. Fournier) Liede, sect. et stat. nov. Basionym: *Telminostelma* E. Fournier in Martius, Fl. Brasil. 6(4): 218. 1885. TYPE: *Telminostelma roulinioides* E. Fournier.

Plants large twiners (5 m tall or taller), leaves large to very large, ovate, basally broadly cordate, inflorescences axillary, frequently richly, at least basally dichasially branched, many-flowered, corolla lobes glabrous or with trichomes, corona of basally fused staminal and interstaminal parts, either might be differentiated, gynostegium sessile or stipitate, pollinaria characteristically with long translator arms, stylar head flat, fruits, as far as known, very large and thick-walled.

The species of this section are found in Central and northern South America. All species seem to be rare, and most of them are known from a few collections only. This section is particularly interesting for its strong resemblance to Gonolobeae genera, and its thorough study might shed light on the origins of the subtribe Gonolobinae.

This section is taxonomically particularly difficult. Sundell (1981) described *Cynanchum* sect. *Metalepis* (Grisebach) Sundell, based on *Metalepis cubense* Grisebach. Morillo (1991), without considering Sundell's work, recognized the genus *Metalepis*, described several new species, and published two new combinations. At the same time as Sundell, however, Fontella and Schwarz (1981) transferred *Metalepis* to the Gonolobeae following the study of the isosyntype of *M. cubense* (*Wright 2799*), a placement independently suggested by Liede and Albers (1994). Sundell admits to not having seen the type of his new

section. The other species placed in section *Metalepis* by Sundell (1981), *C. ekmannii* (Malme) Sundell, is recognized as Asclepiadeae by Fontella and Schwarz (1981). From this history it emerges that both section *Metalepis* (Grisebach) Sundell and the new descriptions and combinations of Morillo (1991) need correction.

Fontella and Schwarz (1981) suggested placing the remaining species of section *Metalepis* together with the species of section *Roulina* (Decaisne) Sundell and *Mellichampia* (A. Gray ex S. Watson) Sundell into the genus *Telminostelma* E. Fournier. The type of *Telminostelma, T. roulinioides* E. Fournier, constitutes a synonym of *Roulinia parviflora* Decaisne (*C. contrapetalum* Sundell). This species, excluded from subgenus *Mellichampia* by Sundell (1981), is characterized by a corona of fused staminal and interstaminal parts, with the lobes, however, in interstaminal position. The same feature is clearly shown in the drawing of *Metalepis prevostiae* Morillo, even though Morillo (1991) does not even mention this peculiarity in the text. Such a shift in the position of the main corona lobes, although uncommon and problematically functional, is by no means absent in *Cynanchum* (e.g., the *C. lineare* N. E. Brown and *C. danguyanum* Choux groups in Madagascar). Therefore, it is insufficient for the delimitation of an independent genus. *Cynanchum ekmannii, C. contrapetalum,* and the species subsumed under *Metalepis* by Morillo (1991) form a well-delimited group of species, which, however, cannot be regarded as an independent genus unless the same status were granted to *Mellichampia* and *Roulinia* as well. As such a split seems undesirable at present, it is suggested here to delimit this group of species as a section under *Cynanchum.* It needs to be mentioned, though, that the inclusion of section *Mellichampia* and section *Roulinia* in a genus *Telminostelma* as suggested by Fontella and Schwarz (1981) seems equally undesirable at present, because section *Roulina,* in particular, is morphologically quite similar to members of section *Cynanchum* from Africa and Asia. As a corollary to the present discussion it might be noted that the new combination *T. foetidum* (Cavanilles) Fontella & E. A. Schwarz unites *C. foetidum* (Cavanilles) Kunth and *C. montevidense* Sprengel, two very different species from Central and South America, respectively.

Cynanchum brasiliense (Morillo) Liede, comb. nov. Basionym: *Metalepis brasiliense* Morillo, Ernstia 1(2): 54. 1991. TYPE: Brazil. Rio de Janeiro: 1876, *Glaziou 7763* (holotype, C; isotype, LE).

Cynanchum gentryi (Morillo) Liede, comb. nov. Basionym: *Metalepis gentryi* Morillo, Ernstia 1(2): 54. 1991. TYPE: Ecuador. Los Ríos: between Mocachi and Palenque, on Estero Peña fiel, 70 m, Jan. 1981, *Gentry 30991* (holotype, MO; isotype, GB).

Cynanchum gilbertii Liede, nom. et comb. nov. Replaced name: *Metalepis prevostiae* Morillo, Ernstia 1(2): 55. 1991. TYPE: French Guyana. Cayenne: Bord de la piste, route de l'Est, km 58, July 1979, *Prevost 715* (holotype, CAY; isotypes, MY, VEN).

C. albiflorum (Urban) Woodson
C. brasiliense (Morillo) Liede
C. contrapetalum Sundell
C. ekmannii (Malme) Sundell
C. gentryi (Morillo) Liede
C. gilbertii Liede
C. haughtii Woodson
C. marsdenioides Woodson
C. peraffine Woodson
C. subpaniculatum Woodson

Cynanchum sect. **Roulinia** (see Sundell, 1981)

Cynanchum sect. **Mellichampia** (see Sundell, 1981)

Orthosia Decaisne in Candolle, Prodr. 8: 526. 1844. TYPE: *Orthosia congesta* (Vellozo) Decaisne.

Amphistelma Grisebach, Fl. Brit. W. I.: 417. 1862. TYPE: *Amphistelma leptocladon* (Decaisne) Grisebach.

Plants forming herbaceous, large, twining tangles, usually dichasially branched, shoots green, ridged, leaves ovate, usually apically acute, basally rounded, inflorescences extra-axillary to axillary, flowers small (usually less than 5 mm diam.), often dark colored, corolla lobes usually glabrous (occasionally with short conical trichomes), corona of basally fused staminal and interstaminal parts, only staminal parts differentiated and normally either tridentate or with a prominent central tooth, follicles two per flower, elongate, seeds very long-ovate, cymbiform, (almost) smooth, only apically winged. Widespread from the Caribbean to northern Argentina.

A particularly large and difficult assemblage is formed by the species that have been—or could be—attributed to *Orthosia* and *Amphistelma.* While *Orthosia* is usually easily recognizable by its axillary inflorescences, this character is not prominent in *Amphistelma.* However, intermediates between extra-axillary and axillary inflorescences have been found occasionally in American *Cynanchum* (sect.

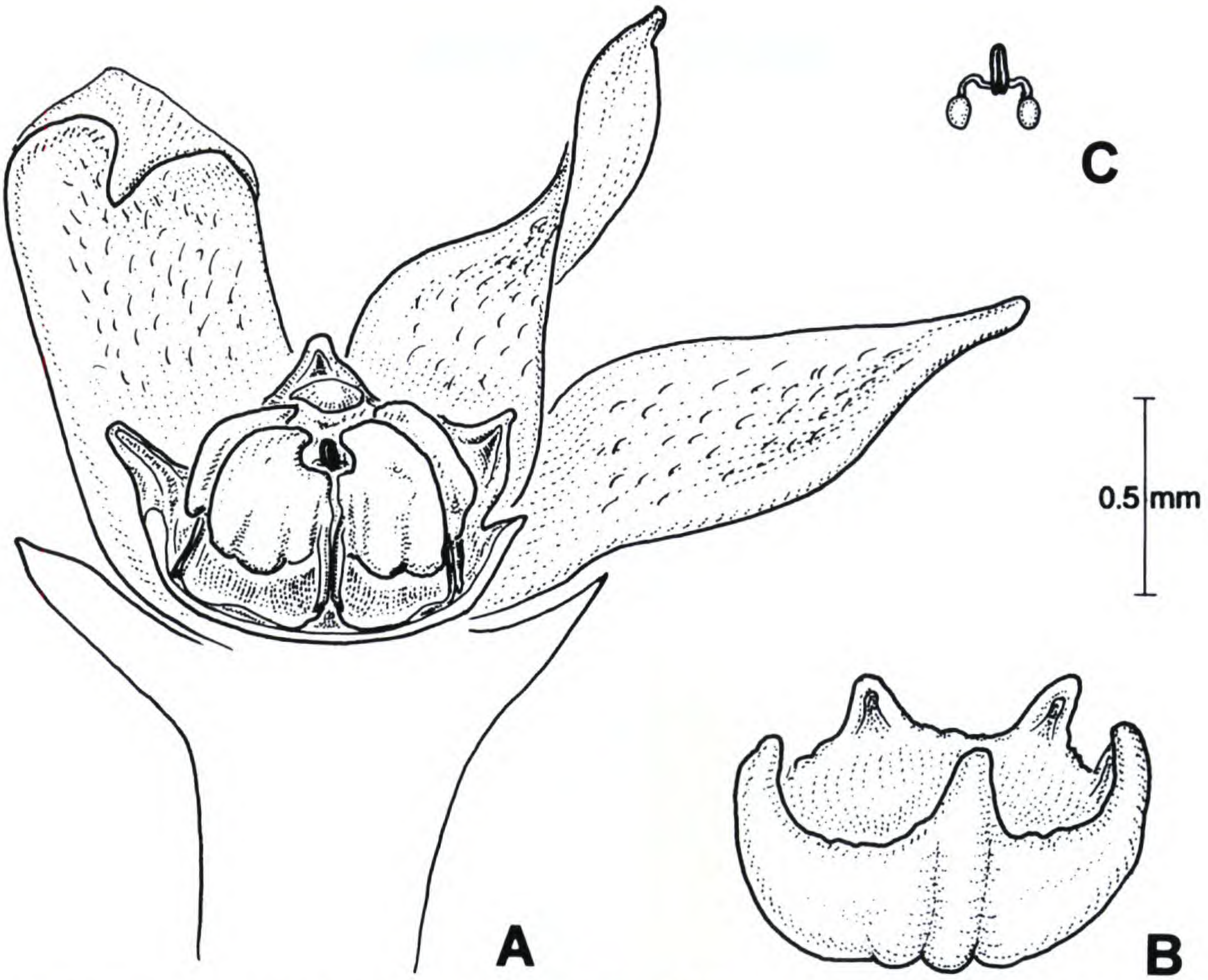

Figure 3. *Cynanchum purpureiflorum* Morillo. —A. Flower. —B. Corona. —C. Pollinarium. (From *Steyermark & Dunsterville 98448*, US, drawn by U. Meve.)

Roulinia; Liede & Weberling, 1995), so that this character cannot be used as "the" generic character of *Orthosia*. Nevertheless, both groups are characterized by a tendency toward leaf reduction, staminal corona lobes with a pointed central tooth, twinned follicles with almost the same diameter over their entire length, and cymbiform, only apically winged, smooth seeds. To my understanding, *Orthosia* including *Amphistelma* thus forms a natural group of species not closely related to *Cynanchum*. In contrast, corona structure and fruit and seed morphology suggest that *Orthosia* represents a sister genus to *Tassadia* Decaisne. This placement is reflected by Fontella and Schwarz (1982), who placed one of the most prominent *Orthosia* species, *O. melantha* Malme of southwestern South America, in *Tassadia*. However, the characteristic inflorescence structure and the usually double corona separate *Tassadia* from *Orthosia*. On the other hand, delimitation of some *Orthosia* against species of *Cynanchum* sect. *Microphyllum* is difficult in many cases, especially if the material does not show flowers, fruits, and seeds. Furthermore, I expect a high degree of synonymy among these taxa, because *Orthosia* species seem to be by far more widespread than their *Cynanchum* counterparts. For these reasons, and in order not to upset the already difficult nomenclature of American Cynanchinae, the numerous new combinations necessary if *Orthosia* is recognized as a genus are not performed here. Rather, a checklist of existing names and of species presently included in other genera is presented to create a basis for a future revision of this difficult group.

Orthosia arenosa Decaisne
O. bahiensis Schlechter
O. congesta (Vellozo) Decaisne (incl. *O. decaisnei* E. Fournier, *O. urceolata* E. Fournier)
O. dusenii (Malme) Fontella
O. ecuadoriensis Schlechter
O. eichleri E. Fournier
O. grandis Handel-Mazzetti
O. itatiaiensis Malme
O. kunthii Decaisne (incl. *A. graminifolium* Grisebach, *C. lanceolatum* Kunth, *C. bonplandianum*

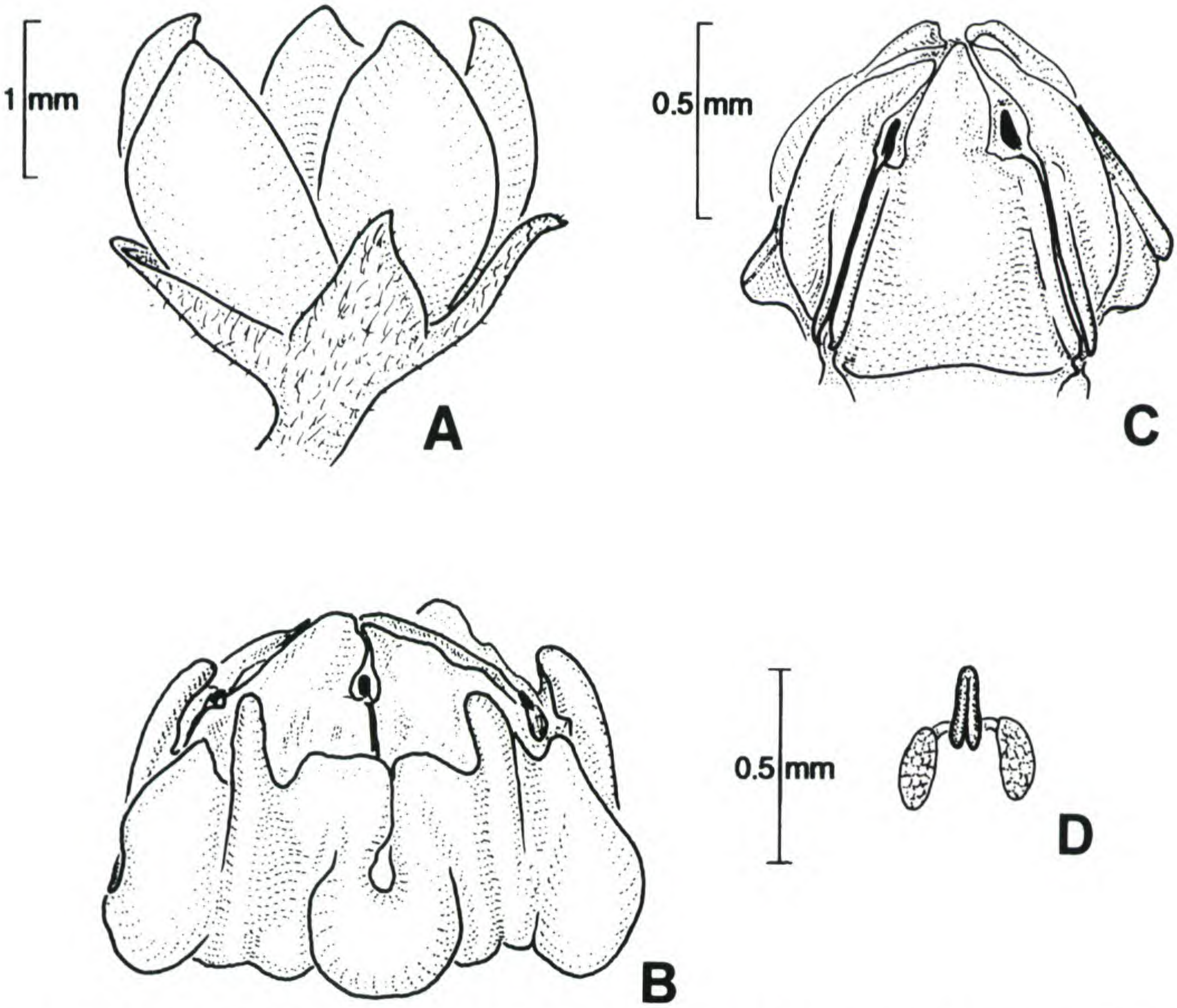

Figure 4. *Cynanchum wurdackii* Morillo. —A. Flower. —B. Gynostegium with corona. —C. Gynostegium. —D. Pollinarium. (From *Erikson 59107*, AAU, drawn by U. Meve.)

Roemer & Schultes, *Metastelma angustifolium* Turczaninow, *C. wigginsii* Shinners)
O. latipes Malme
O. loandensis Fontella & Valente
O. mollis Schlechter
O. multiflora E. Fournier
O. paniculata Klotzsch
O. serpyllifolia (Kunth) Decaisne
O. stenophylla Schlechter
O. suberosa Decaisne
O. tarmensis Schlechter
O. thymifolia Schlechter
O. tomentosa (E. Fournier) Malme
O. trianaei Schlechter
O. umbrosa Decaisne
Amphistelma atrorubens Schlechter
A. ephedroides Grisebach
A. ferrugineum E. Fournier
A. filiforme Grisebach
A. leptocladon (Decaisne) Schlechter
A. parviflorum E. Fournier
A. pearcei Rusby
A. riedelii E. Fournier
A. scoparium Nuttall
A. selloanum E. Fournier
Cynanchum balslevii Morillo
C. beckii Morillo
C. bonariense (Decaisne) T. Meyer
C. campii Morillo
C. carmensemiliae Morillo
C. cassythoides Suessenguth
C. dombeyanum (Decaisne) Morillo
C. dorrii Morillo
C. ellemannii Morillo
C. fernandezii Morillo
C. funale Poiret
C. glaberrimum L. O. Williams
C. isidrensis Morillo
C. meridense Morillo
C. miserum L. O. Williams
C. pichinchense K. Schumann
C. purpureiflorum Morillo (Fig. 3)
C. samuelsonii Malme
C. sepium (Decaisne) Standley

C. sodiroi K. Schumann
C. stannardii Morillo
C. stenospira Schlechter
C. tamense Morillo
C. trifurcatum (Grisebach) Lillo
C. wurdackii Morillo (Fig. 4)
Metastelma pubescens (Greenman) W. D. Stevens
M. rariflorum Schlechter
M. retinaculatum Schlechter
M. rubens (L. O. Williams) W. D. Stevens
Tassadia subulata (Vellozo) Fontella & E. A. Schwarz [incl. *O. melantha* (Decaisne) Malme]

Uncertain Species

For some species, the affinity could not be determined with certainty, mostly due to lacking or incomplete material. These species include:
C. cardozoi Morillo
C. caudigerum R. W. Holm
C. confusum R. W. Holm
C. ekmanii Alain (nom. and comb. nov. for *Astephanus schlechterianus* Urban; non *C. ekmannii* (Malme) Sundell)
C. erikseniae Morillo
C. fasciculiflorum Morillo
C. granatense (Baillon) Morillo
C. guanchezii Morillo
C. leucophellum Diels
C. mariquitense Mutis
C. microphylum Rafinesque
C. pallidum Sessé & Moçiño
C. robertii (S. Moore) Malme
C. rusbyi Malme
C. tabascence Sessé & Moçiño
C. trollii Liede & Meve ined.
C. unguiculatum Ruiz & Pavón
C. uniflorum Sessé & Moçiño
C. violator R. W. Holm

Excluded Species

Cynanchum harlingii Morillo probably represents a species of *Blepharodon* close to *B. mucronatum* Decaisne.
C. jenmanni Morillo belongs to the subtribe Gonolobinae.
C. sarcostemma Lillo

Acknowledgments. For long-term loan of specimens, I owe gratitude to the directors of the institutions listed in Materials and Methods. The DFG has supported my Asclepiadaceae work financially (grants LI 496/1–4).

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Two New Species of *Cissus* (Vitaceae) from Central and South America

Julio Antonio Lombardi

Departamento de Botânica, Instituto de Ciências Biológicas, Universidade Federal de Minas Gerais, Av. Antônio Carlos 6627, 31270-110, Belo Horizonte, MG, Brazil

ABSTRACT. *Cissus pseudoverticillata* and *C. anisophylla*, new taxa of Vitaceae, are described from Central and South America. In addition to descriptions and illustrations, comments on their probable relationships and distributions are provided.

The 33 previously described species of *Cissus* L. recognized in the flora of South America (Lombardi, 1995) have been augmented by many new species discovered by the author in revising the genus for the area. With the discovery of additional specimens, two new species are described here: *Cissus pseudoverticillata*, from Peru and Bolivia, and *C. anisophylla*, from Ecuador and Panama.

Cissus pseudoverticillata Lombardi, sp. nov. TYPE: Peru. Madre de Dios: corner of Secondary Floodplain Forest Hectare Plot # 4, along Sunset Point Trail, Explorer's Inn, near the confluence of Río Tambopata and Río La Torre, 39 km SW of Puerto Maldonado, 12°50′S, 69°20′W, 15 Oct. 1985 (fl, young fr), *S. F. Smith, Kahn & Shuhler 770* (holotype, US; isotype, F). Figure 1.

Frutex scandens, pilis brevis et parte reproductiva restricta, foliis simplicibus, *C. verticillatae* (L.) Nicolson et Jarvis simulans, sed pedicelis et calyce puberulis et plantis siccis olivo-viridis coloratis differt.

Liana; stems glabrous, cylindric, drying striate and olive green; reproductive shoots sometimes aphyllous on the apex. Tendrils 2-branched, glabrous, with adhesive discs; scales ca. 0.1 cm long, deltate, glabrous. Trichomes restricted to reproductive parts, not ramified and uni- to bicellular. Leaves simple, drying olive green; petioles 1–6.3 cm long, glabrous, canaliculate; stipules 0.1–0.15 × 0.1 cm, rhombic, glabrous, ciliate, papyraceous; lamina 4.3–13.3 × 1.5–10.1 cm, elliptic, ovate, on the apex of the reproductive shoots narrowly elliptic, apex acuminate, margin sparsely denticulate, slightly revolute, bases rounded to cuneate, markedly revolute at the junction with the petiole, carnose. Compound cymes 2.9–5.7 × 3–5.4 cm; peduncles 0.9–2.7 cm long, puberulous, green; bracts ca. 0.1 cm long, triangular, glabrous, ciliate; pedicels 0.1–0.25 cm long, puberulous, green; calyx ca. 0.1 cm long × 0.1–0.2 cm diam., truncate, puberulous, carnose, green; corolla in bud 0.1–0.2 cm long × 0.1–0.2 cm diam.; petals glabrous, carnose, green; stamens 4, filaments granulose, anthers adherent at pairs in bud, dehiscence latrorse, connective triangular, granulose, drying clear yellowish; disc apex slightly concave to flat; style cylindric, stigma obscure. Mature fruit not seen, seed not seen.

Cissus pseudoverticillata differs from the other simple-leaved neotropical species in its puberulous pedicels and calyx, the unbranched and paucicellular trichomes, and the characteristic olive green color of the dried plant. It is known from the borders of rainforests and secondary growths in Peru and Bolivia.

A sterile collection from Brazil (State of Acre) has been examined by the author, but not preserved.

This species is very similar, and perhaps closely related, to *Cissus verticillata* subsp. *verticillata*, but is easily distinguished by the trichomes on the flowers.

The abnormal size of some closed buds is due to the insect larvae, probably gall formers, that are found inside.

Paratypes. PERU. **Madre de Dios:** Cocha Cashu Camp, Río Manu, Parque Nacional del Manu, 380 m, Transect 4, 18 Oct. 1979 (st), *Gentry et al. 26904* (F); Tambopata, alrededores del Albergue Turístico Cusco Amazónico, margen izquierda del Río Madre de Dios, ca. 35 km de Puerto Maldonado, 200 m, 29 Oct. 1988 (fl, young fr), *Nuñez et al. 10025* (F, MO not seen). BOLIVIA. **Santa Cruz:** Prov. Ichilo, Parque Nacional Amboro, 0–2 km SW of El Carmen, 17°32′S, 63°42′W, 360 m, 9 Nov. 1990 (fl), *Nee 39830* (CTES, NY not seen).

Cissus anisophylla Lombardi, sp. nov. TYPE: Ecuador. Los Ríos: Río Palenque Biological Station, km 56 Quevedo-Santo Domingo, 150–220 m, 18 Mar. 1974 (fl), *Dodson 5515* (holotype, US). Figure 2.

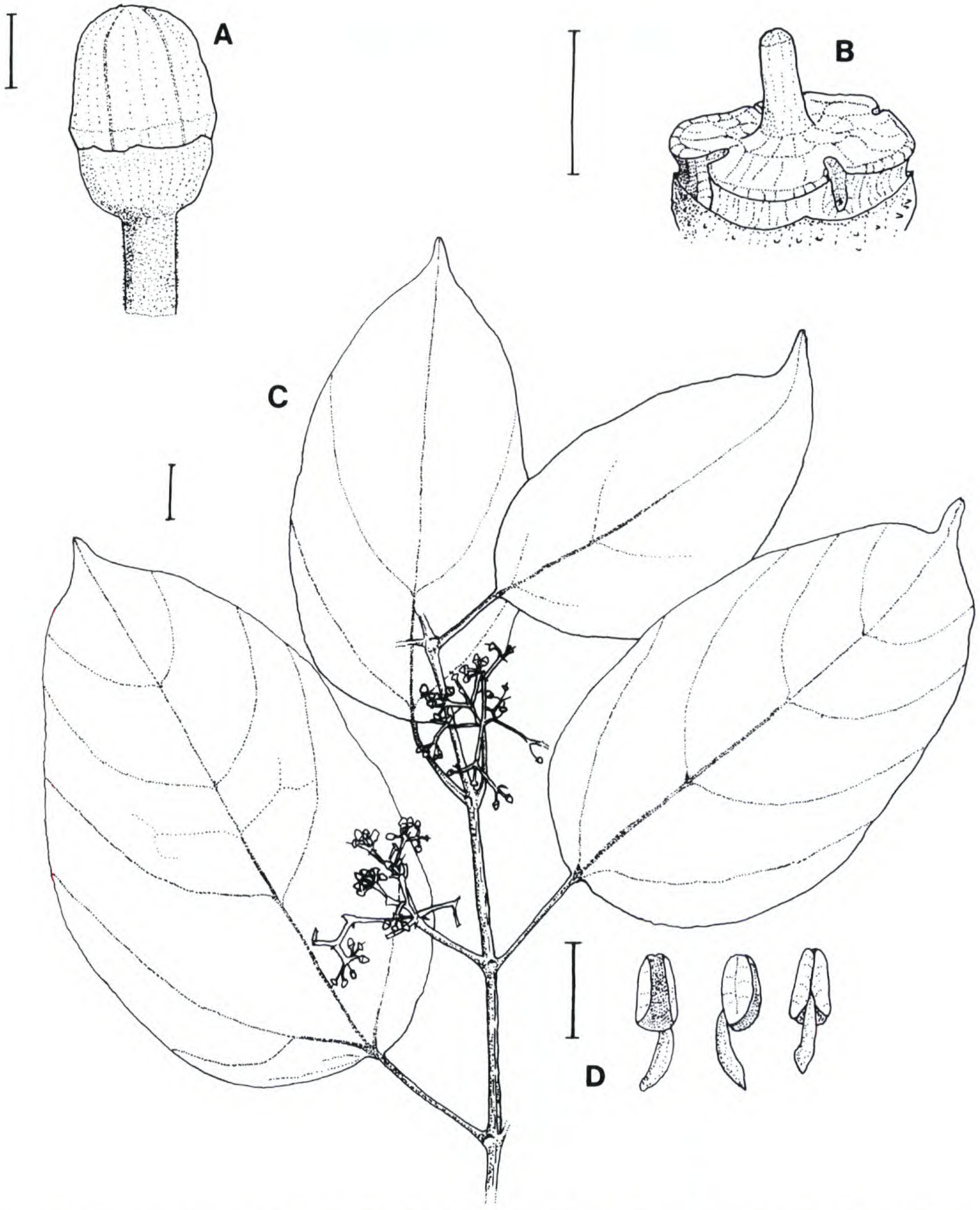

Figure 1. *Cissus pseudoverticillata* Lombardi. —A. Flower bud. —B. Nectariferous disc and pistil. —C. Reproductive branch. —D. Stamens, ventral, lateral, and dorsal views. A–D from *S. F. Smith, Kahn & Shuhler 770.* Scales A, B, D = 1 mm, C = 1 cm. Drawn by the author.

Frutex scandens, trichomatibus malpighiaceis, foliis simplicibus, floralibus minoribus et diversis, *C. pseudofuligineae* Lombardi simulans, sed denso indumento, ramiis non glaucescentibus, foliis cordatis vel triangularibus in ramiis vegetatilibus, stipulis triangularibus, et disco lobis elevatis differt.

Liana; stems tomentose, sparsely sericeous to glabrous, subcylindric to 4-angled. Tendrils not ramified, glabrous, adhesive discs not seen; scales ca. 0.1 cm long, deltate and prominent, glabrous. Trichomes malpighiaceous. Leaves simple, drying dark olive green;

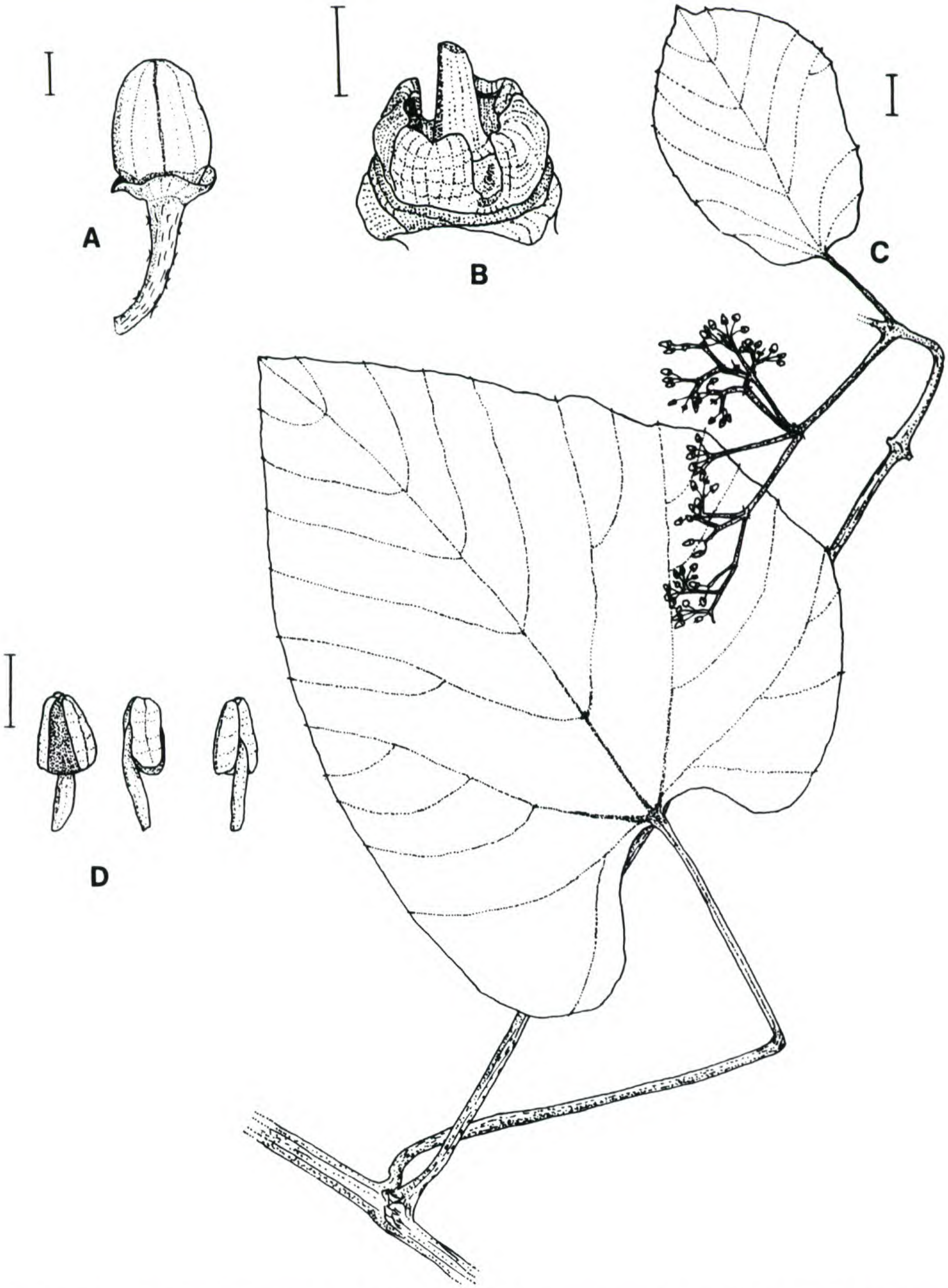

Figure 2. *Cissus anisophylla* Lombardi. —A. Flower bud. —B. Nectariferous disc and pistil. —C. Reproductive branch. —D. Stamens, ventral, lateral, and dorsal views. A, B, D from *Dodson 5515*, C from *Gentry 10139*. Scales A, B, D = 1 mm; C = 1 cm. Drawn by the author.

petioles 1.6–19.1 cm long, sparsely sericeous to tomentose, canaliculate; stipules 0.15–0.3 × 0.2 cm, triangular, sparsely pilose at the apex and margin to glabrescent, caducous, basal part shed before the apical part, remainder attached to stem at the medial part, carnose; lamina 7.8–23 × 4–18.5 cm, on vegetative shoots cordate to triangular, on reproductive shoots rhombic, panduriform, elliptic, to oblong, apex acute to acuminate, margin denticulate, bases cordate, truncate to rarely sagittate, young leaves hirsute on the abaxial side to sparsely sericeous on both sides, mature leaves very sparsely sericeous on both sides to glabrescent, herbaceous. Compound cymes 8.3–11.7 × 8–9.1 cm; peduncles 3–4.8 cm long, sparsely sericeous on the bases, and tomentose on the branches, green; bracts ca. 0.1 cm long, triangular, glabrous to pilose on the apex and bases, ciliate, drying blackish; pedicels 0.3–0.5 cm long, sericeous, green; calyx 0.05–0.1 cm long × 0.15–0.4 cm diam., lobes deltate and ciliate, sparsely sericeous, yellow-green; corolla in bud 0.2–0.3 cm long × 0.15–0.2 cm diam., petals sparsely sericeous, carnose, yellow-green; stamens 4, dehiscence latrorse, connective triangular, granulose, drying clear yellow; disc apex concave, sides projected on thin lobes; style cylindric, enlarged in medial portion, stigma obscure. Fruit ca. 0.8 × 0.7 cm, subpyriform, smooth, purple; seed ca. 0.8 × 0.6 cm, subpyriform, hilum acute, raphe slightly prominent, sides grooved.

Cissus anisophylla is characterized by its dimorphic leaves, chiefly cordate on vegetative shoots, and smaller and rhombic, panduriform, elliptic, to oblong on reproductive shoots; the malpighiaceous trichomes; and the disc sides projected in a diminutive chamber.

This new species is known from the tropical evergreen forests of Ecuador and Panama.

The relationships of *Cissus anisophylla* to other species are obscure, but this new species is similar in size, and to a minor degree, by the shape of leaves, to *Cissus pseudofuliginea* Lombardi, but *Cissus pseudofuliginea* has glaucescent branches and leaves. The differences in leaves between reproductive and vegetative shoots in *Cissus pseudofuliginea* is not marked, and the variation is more of size than of shape.

Paratypes. PANAMA. **Colón:** Santa Rita lumber road, ca. 15 km E of Colón, not dated (fr), *Dressler 3436* (GH). ECUADOR. **Los Ríos:** hacienda Clementina, 1°40′S, 79°21′W, 80 m, 20 Mar. 1996 (fr), *Cornejo & Bonifaz 4804* (BHCB, GUAY not seen); Río Palenque Field Station, halfway between Quevedo and Santo Domingo de los Colorados, ca. 200 m, 23 Feb. 1974 (fl), *Gentry 10139* (MO not seen, RPSC not seen, SEL, UC). **Pichincha:** km 37 on the road from Santo Domingo to Quevedo, 0°32′S, 79°25′W, 100 m, 11 June 1982 (fr), *Kvist & Holm-Nielsen 40288* (AAU, MA).

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Una Nueva Especie de *Setaria* (Poaceae: Paniceae) para Sudamérica

José F. Pensiero

Miembro de la Carrera del Investigador Científico del CONICET, Facultad de Agronomía y Veterinaria, Universidad Nacional del Litoral, Luis Kreder 2805, 3080 Esperanza, Santa Fe, Argentina

RESUMEN. Se describe una nueva especie del género *Setaria* para Sudamérica, *S. nicorae* Pensiero, la que se ilustra y compara con las especies afines.

ABSTRACT. A new species of *Setaria*, *S. nicorae* Pensiero, from South America is described, illustrated, and compared with its relatives.

Setaria nicorae Pensiero, sp. nov. TIPO: Paraguay. Dpto. Alto Paraguay: Puerto Casado, XII-1916, *Rojas 2359* (holótipo, SI; isótipos, BAA, LIL, US). Figura 1.

Herba foliorum glaucedine insignis, perennis, laxa, cespitosa, ca. (30–)40–90(–100) cm alta; internodis glabris; vaginis apertis; laminae planae, glabrae, ca. 10–30 × 0.4–1(–1.2) cm. Panicula erecta, axe glabro, ca. 6–23 cm longa. Spiculae glabrae, ovoideae, 2–2.5(–2.8) × 1–1.2 mm; setae antrorsae-denticulatae; glumae inferiores longitudine ½ spiculae partes aequantes, 3–5 nervis; glumae superiores longitudine ¾ spiculae partes aequantes, 5–7 nervis; lemmata inferiora anthoecia aequantia, 5–7 nervis. Anthoecia ovoidea, apiculata, leviter rugosa Caryopsides ca. 1.2–1.3 × 1 mm.

Planta perenne, cortamente rizomatosa, cespitosa, macollas apretadas en la base, innovaciones intravaginales, cañas floríferas cilíndricas, de (30–) 40–90(–100) cm de alto y 1.5–3 mm de diám., simples o ramificadas en los nudos inferiores; internodios glabros, lisos, por lo general cubiertos por las vainas; nudos 2–5, glabros o a veces los basales pilosos. Vainas glabras, con el dorso redondeado, los márgenes ciliados, especialmente en su parte superior; cuello con pelos hasta de 1 mm de longitud o glabro. Lígulas membranáceo-ciliadas, de 0.5–1.5 mm de longitud, pudiendo tener a los costados del cuello pelos hasta de 2 mm de longitud, porción membranácea reducida. Láminas linear-lanceoladas, glaucas, de 10–30 × 0.4–1(–1.2) cm, planas, glabras, por lo general retroescabrosas, nervio medio conspicuo, el ápice agudo. Inflorescencia una panoja espiciforme, de 6–23 × 0.5–1(–1.5) cm, incluyendo las setas, a veces con las ramificaciones inferiores hasta de 3 cm longitud y distanciadas del raquis, dando así un aspecto algo piramidal a la inflorescencia; raquis glabro, antrorso-escabroso. Espiguillas ovoides, glabras, de 2–2.5(–2.8) × 1–1.2 mm, acompañadas por una seta antrorso-escabrosa de 0.4–1.2 cm de longitud; gluma inferior alcanzando ½ del largo de la espiguilla, 3–5-nervia, con el ápice agudo u obtuso; gluma superior ¾(–⅘) del largo del antecio superior, 5–7-nervia, apiculada; lema inferior de igual largo que la lema superior, 5–7-nervia, apiculada; pálea inferior normalmente angosta, ¾, ⅘ o igualando el largo de la pálea superior. Antecio superior ovoide, de 2–2.5 × 1–1.2 mm, pajizo, suavemente rugoso, con surcos poco profundos; ápice liso, por lo general apiculado, pálea de igual textura que la lema, de 0.7 mm de latitud. Cariopsis elipsoide, de 1.2–1.3 mm de longitud por 1 mm de latitud, escudete alcanzando ¾ de su longitud; hilo punctiforme.

Distribución geográfica y ecología. Habita en gran parte de Sudamérica: Trinidad y Tobago, Venezuela, Colombia, Perú, Bolivia, Brasil, Paraguay, llegando hasta el centro-norte de Argentina. Especie frecuente en bosques ralos, especialmente donde dominan bromeliáceas, en arbustales, laderas rocosas de cerros y banquinas. Crece desde el nivel del mar hasta los 1100 m s.m.

Nombre vernáculo. "Espartillorà" (Paraguay).

Esta especie es dedicada a Elisa G. Nicora, eminente agrostóloga argentina.

Se pudieron observar algunas variaciones tales como: el largo de la espiguilla, que en algunos ejemplares estudiados—*Piccinini & Hilfer 4195, Schulz 17617, Pedersen 12900, Molas & Vera 1222*—pueden alcanzar 2.8 mm de longitud; la gluma superior puede alcanzar ⅘ del largo del antecio superior—*Saravia Toledo 12226*; o presentar el raquis de la inflorescencia algo piloso—*Bunting 7947, Haugh 4368, Dugand 5841.*

Parte de los materiales aquí citados, y la ilustración que se presenta, fueron incluidos por Pensiero (1993, 1995) bajo *Setaria setosa* (Swartz) P. Beauvois. El estudio de materiales tipos de esta última especie, permitió aclarar su identidad y separarla de esta especie nueva que se propone.

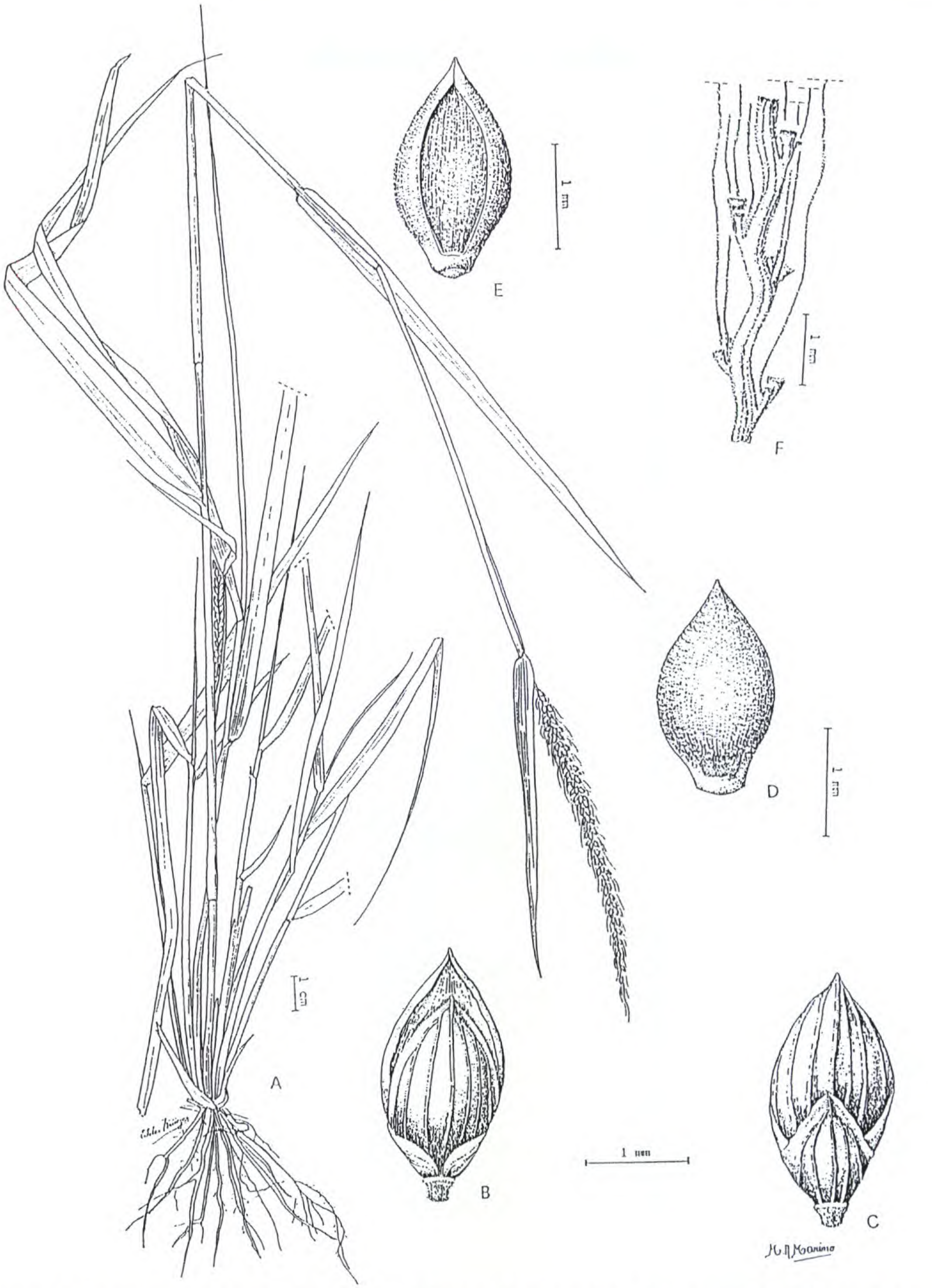

Figura 1. *Setaria nicorae* Pensiero. —A. Hábito. —B. Espiguilla vista desde la gluma superior. —C. Espiguilla vista desde la gluma inferior. —D. Antecio superior vista dorsal. —E. Antecio superior vista ventral. —F. Porción de rama. (A, de *Petetín & Molina 1075*; resto de *Petetín et al. 1746*; tomado de Pensiero, 1993.)

Parátipos. ARGENTINA. **Córdoba:** Dpto. Pocho, Reserva Chancaní, Picada Central, 370 m s.m., 16-III-1989, *Cabido 20054* (CORD); Reserva Chancaní, ± 390 m s.m., 28-III-1989, *Cabido 20055, 20056* (CORD). **Corrientes:** Dpto. Mercedes, Mercedes, 10-II-1925, *Millán 413* (SI). **Chaco:** Dpto. Gral. Güemes, Fuerte Esperanza, en el llamado Impenetrable, 20-I-1980, *Piccinini & Hilfer 4140* (BAB); entre Colonia Castelli y Fortín Lavalle, 19-I-1949, *Ragonese & Castiglioni 7022* (BAB); Dpto. 1° de Mayo, Margarita Belén, 6-XI-1946, *Aguilar 953* (LIL, MO,

US); Dpto. Tapenagá, Árbol Solo, 26-II-1936, *Meyer 2547* (BAA). **Formosa:** Dpto. Matacos, Ing. Juárez, 3-VI-1980, *Pedersen 12900* (Herb. Pedersen); Dpto. Patiño, Nuevo Porteño, 25-I-1972, *Schultes 17956* (CTES); Bartolomé de las Casas, 9-X-1970, *Schulz 17611, 17617* (CTES); Bartolomé de Las Casas, VII-1971, *Insfran 1159* (CTES); Ruta 81, 30 km O de Palo Santo, 15-I-1981, *Petetín & Molina 1075* (BAB); mitad de camino entre ruta 81 y Villa Gral. Güemes, km 32 de ruta 81, *Petetín et al. 1746* (BAB); Las Lomitas, 24-I-1928, *Parodi 8431* (BAA, US); 3 km del desvío de ruta 22 a Cogoik, 15-XI-1991, *Fortunato et al. 2312* (SI); Dpto. Pilcomayo, Est. Salaberri, 12 km de Filipina, 18-XI-1949, *Morel 8911* (LIL, US); Parque Nacional Pilcomayo, cerca de la Laguna Blanca, 25°10′N, 58°6′W, 8-XI-1991, *Fortunato et al. 2089* (SI); Dpto. Pirané, Ruta 23, 5 km S de Palo Santo, 16-I-1981, *Petetín & Molina 1182* (BAB). **Salta:** Dpto. Anta, El Milagro, 15-V-1959, *Morello & Cuezzo 1120* (LIL); camino San Lovero a San Javier, 29-III-1985, *Del Castillo 694* (MCNS); Pozo Largo, 10 km SE de J. V. González, 340 m s.m., 22-I-1988, *Saravia Toledo 1552* (SF); Dpto. La Viña, Coronel Moldes, 2-II-1941, *Hunziker A. 1071* (LIL). **Santa Fe:** Dpto. Gral. Obligado, Villa Guillermina, 26-II-1939, *Meyer 2547* (CTES); Villa Guillermina, 14-XII-1938, *Meyer 2778* (LIL). **Santiago del Estero:** Dpto. Avellaneda, Mailín, *Della Tea 49* (SF); Dpto. Carlos Pellegrini, El 14, XII-1932, *Peirano 8937* (BAA); Dpto. Loreto, Campo "La María," 30 km S de Santiago del Estero, Sierra Guasayán, 1-II-1981, *Kunst 77* (CORD). Dpto. Matará, Campo del Cielo, 27-XII-1946, *Schulz 1096* (LIL). BOLIVIA. **Santa Cruz:** Cordillera, Abapo-Izozog Agricultural Res. Stn., 400 m s.m., 12-III-1981, *Renvoize et al. 3909* (K, MO). **Valle Grande–Santa Cruz:** Ruta a Valle Grande, 28-I-1994, *Saravia Toledo 12226* (SI). BRASIL. **Mato Grosso do Sul:** Municipio de Corumbá, Faz. Bodoquena, Carandazal, 27-X-1978, *Allem et al. 2208* (MO). COLOMBIA. **Atlántico:** Costa del Caribe, playa de Ferú o Santa Verónica, 6-X-1961, *Dugand 5841* (US); Dpto. Magdalena, Santa Marta, 3 mi. from Playa Brava, 1898/1899, *Smith 2188* (MO, NY); near Fonseca, 22-IX-1944, *Haugh 4368* (US). PARAGUAY. **Alto Paraguay:** Bahía Negra, 9-XI-1946, *Rojas 13711 b* (LIL); Bahía Negra, 25-XI-1946, *Rojas 13802* (BAA, LIL, US); Fuerte Olimpo, 12-XII-1946, *Rojas 13853* (BA, LIL); 10 km SO de San Carlos, 22-IX-1986, *Molas & Vera 1222* (PY); Puerto Palma Chica, XII-1937, *Rojas 7601, 7837* (BAA); Km 220, Sector Puerto Casado, X-1938, *Rojas 8450* (BAA); Puerto Casado, 13-I-1917, *Rojas 10742* (US). **Boquerón:** 60 km de la 7a. División de Infantería, 25-X-1986, *Molas 1409* (MO). **Central:** Entre General Garay y Asunción, 20/26-X-1975, *Adamoli et al. 133* (BAA). **Nueva Asunción:** 60 km O de Est. La Patria, 7-XII-1992, *Nicora et al. 9748* (SI). **Presidente Hayes:** Ruta Trans Chaco, km 245, 18-XII-1987, *Schinini & Palacios 26378* (SF). PERÚ. **Amazonas:** Prov. Bagua, entre Bagua Chica y Amojao, cerca al Pongo de Rentema, 27-VII-1959, *Ferreyra 13663* (US). TRINIDAD Y TOBAGO. Chacachacare, 4-XII-1912, *Hitchcock 10059* (BAA, US). VENEZUELA. **Distrito Federal:** Entre Caracas y La Guaira, 23-VI-1946, *Burkart 16996* (SI). **Lara:** Barquisimeto, en la Loma de León, 6-VII-1946, *Burkart 17132* (SI); Cerro de Manzano, Dto. Iribarren, 19-IX-1950, *Tamayo 3741* (NY). **Zulia:** Distrito Bolivar, Parque Yaguasa, entre la carretera internacional y el Lago de Maracaibo, 24-IX-1979, *Bunting 7947* (MO).

Según el esquema taxonómico propuesto por Pensiero (1995), *S. nicorae* pertenece al subgénero *Setaria*, ya que las láminas carecen de pliegues longitudinales y todas las espiguillas se encuentran acompañadas por una seta. La siguiente clave permite diferenciar esta nueva especie de aquellas más afines:

1a. Raquis de la inflorescencia glabro; antecio superior suavemente rugoso, con surcos apenas insinuados . . . . . *Setaria nicorae* Pensiero

1b. Raquis de la inflorescencia hirsuto; antecio superior rugoso, con surcos conspicuos especialmente en su parte media basal.

2a. Láminas menores de 0.7 cm de latitud, hirsutas; antecio superior ovoide . . . . . *Setaria setosa* (Swartz) P. Beauvois

2b. Láminas mayores de 0.7 cm de latitud, glabras, rara vez algo pubescentes; antecio superior ovoide o anchamente ovoide . . . . . *Setaria macrostachya* Kunth

Literatura Citada

Pensiero, J. F. 1993. Notas sobre el género *Setaria* (*Poaceae: Paniceae*). Bol. Soc. Argent. Bot. 29 (1–2): 53–66.

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Diospyros morenoi (Ebenaceae), a New Species from Nicaragua

Amy Pool

Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. *Diospyros morenoi*, a new species from the oak forests of northwestern Nicaragua, is described, and its relationships to similar Central American species are discussed.

A new species of *Diospyros* encountered in the course of preparing a treatment of the Ebenaceae for the *Flora de Nicaragua* is here described and illustrated.

Diospyros morenoi A. Pool, sp. nov. TYPE: Nicaragua. Departamento de Madriz: S of Somoto, between Valle Santa Teresa and El Rodeo, 13°27′N, 86°34′W, 800–900 m, heavily grazed oak forest on rocky slopes, 12 July 1983 (immature fr), *W. D. Stevens & Pedro P. Moreno 22224* (holotype, MO; isotypes, BM, CR, EAP, F, FHO, HNMN not seen, MEXU, MICH, NY, P, TEX, US). Figure 1.

Arbor grandis. Folia infra dense villosa. Infructescentia pedicellis geminatis, 12–15 mm longis. Calyx in fructu tomentosus, fere ad basim 5(6)-lobus, lobulis lanceolatis apice acuminatis, valde reflexis. Fructus 10-locularis, exocarpio ca. 0.75 mm lato.

Large tree, young branches tomentose with scattered, long, yellowish hairs. Leaf blades elliptic with acute apex and base, 8.3–10.5 cm long, 3.5–4.5 cm wide, 6–10 pairs of secondary veins, adaxial surface puberulent, abaxial surface densely villous; petiole 3–8 mm. Flowering material unknown. Fruiting pedicels paired, 12–15 mm long; calyx tomentose, 5(6)-lobed almost to base, lobes ca. 15 mm long, lanceolate with acuminate apex, strongly reflexed from base; fruit (probably immature) depressed-globose, green, glabrescent, puberulent at base and apex, to ca. 4 cm wide, and ca. 2.5 cm high, exocarp ca. 0.75 mm thick, 10-locular, 6–7-seeded.

Diospyros morenoi appears to be most closely related to *Diospyros conzattii* Standley (including *Diospyros pergamentacea* Lundell), endemic to the state of Oaxaca, Mexico. They are similar in having a calyx 5-lobate nearly to base with the lobes lanceolate with acute to acuminate apices and strongly reflexed in fruit. The fruit walls of *D. conzattii* are also relatively thick (S. Knapp, pers. comm.). *Diospyros conzattii* differs in having glabrous leaves.

Only two species from Central America, in addition to *D. morenoi*, have densely pubescent leaves and a calyx 5-lobate nearly to base. *Diospyros rekoi* Standley, known from the Mexican states of Guerrero and México, is perhaps the more similar. The only mature fruit that I have seen is moldy and fragmented, with the calyx missing. Immature fruits to 2 cm wide have ascending calyx lobes with acute to obtuse apices. The fruits are densely velutinous with the exocarp 0.35 mm thick. *Diospyros oaxacana* Standley, known from the Mexican states of Oaxaca and Veracruz, has pistillate flowers solitary in the leaf axils, calyx lobes reflexed in fruit, oblong to slightly pandurate with obtuse to acute apices, and fruit with exocarp 0.3 mm thick.

Acknowledgments. I thank W. D. Stevens and Sandra Knapp for their advice and encouragement, John Myers for providing the illustration, and Roy Gereau for assistance in preparing the Latin description.

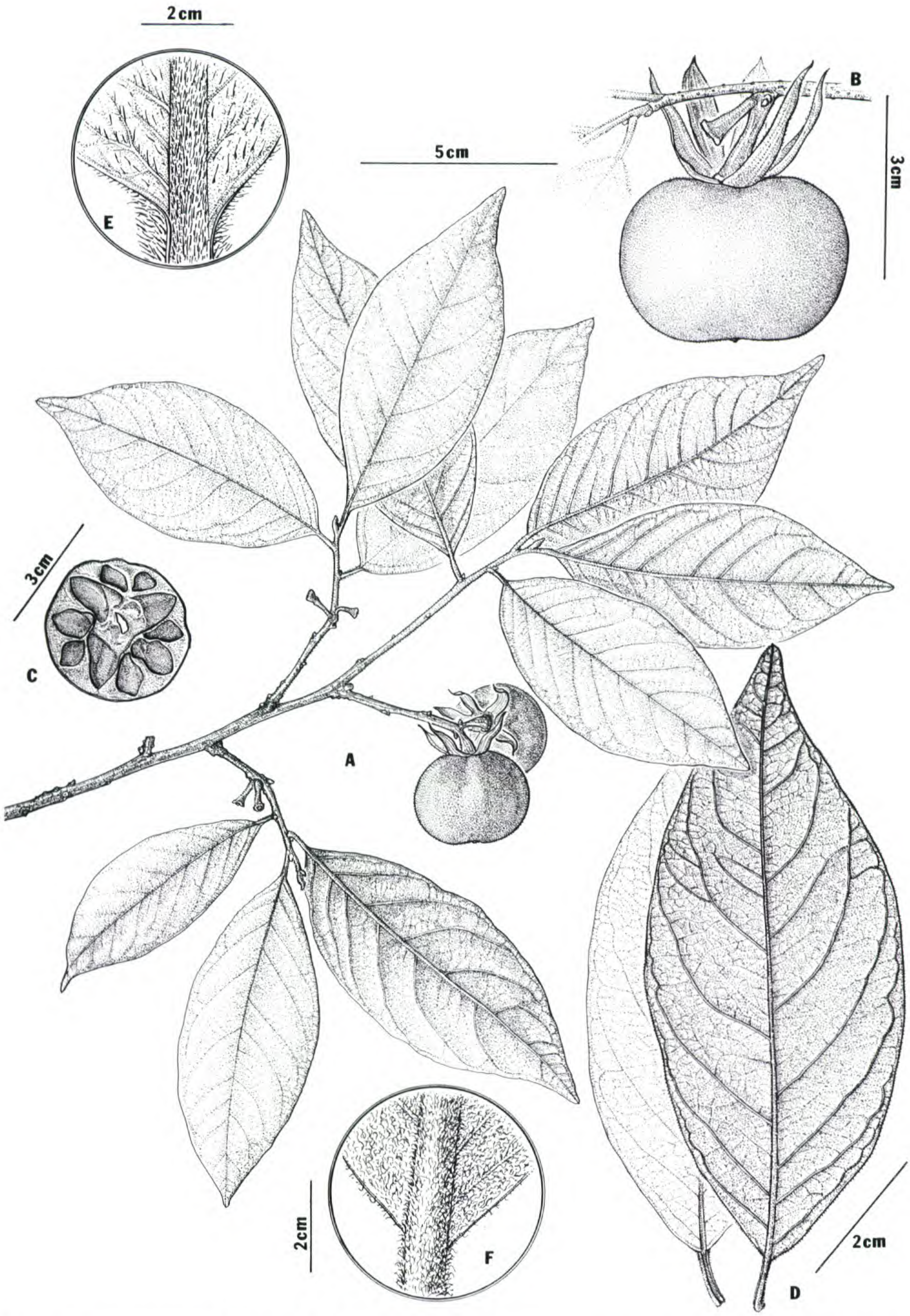

Figure 1. *Diospyros morenoi* A. Pool. —A. Habit. —B. Fruit. —C. Fruit cross section. —D. Leaves. —E. Leaf adaxial surface. —F. Leaf abaxial surface.

New Species of *Palicourea* and *Psychotria* (Rubiaceae: Psychotrieae) from Northwestern Colombia

Charlotte M. Taylor
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. The new species *Palicourea orquidea*, *Palicourea quadrilateralis*, *Palicourea sopkinii*, *Palicourea zarucchii*, *Psychotria ovatistipula*, *Psychotria sanchezii*, and *Psychotria vesciculifera* are described and illustrated. These are all shrubs or small trees found in wet forests at 520–2500 m in the Pacific slope and Cordilleras Occidental and Central of Antioquia and Chocó Departments, Colombia.

RESUMEN. Se describen e ilustran las especies nuevas *Palicourea orquidea*, *Palicourea quadrilateralis*, *Palicourea sopkinii*, *Palicourea zarucchii*, *Psychotria ovatistipula*, *Psychotria sanchezii* y *Psychotria vesciculifera*. Todas son arbustos o arbolitos que crecen en bosques húmedos de 520–2500 m en la vertiente del Pacífico y las Cordilleras Occidental y Central de los Departmentos de Antioquia y el Chocó, Colombia.

Among recent collections from northwestern Colombia, the following undescribed species of the related genera *Palicourea* Aublet and *Psychotria* L. were represented. Descriptions of these two genera and keys to distinguish them have been presented by Burger and Taylor (1993).

Palicourea orquidea C. M. Taylor, sp. nov. TYPE: Colombia. Antioquia: municipio de Urrao, Parque Nacional Natural "Las Orquídeas," camino de Calles hacia Venados arriba, sector Bellavista, 1685 m, ca. 6°30′N, 76°20′W, 7 July 1991, *A. Cogollo, C. Builes & O. Alvarez 5036* (holotype, MO-4281229; isotype, JAUM not seen). Figure 1A, B.

Species a congeneribus habitu satis succulento, foliis brevipetiolatis satis grandibus, stipulis satis grandibus profunde bilobis, inflorescentia congesta spiciformi bracteis bene evolutis praedita distinguenda.

Shrubs flowering at 2 m tall, to 4 m tall, rather succulent, sparsely branched; stems quadrate, stout, glabrous. *Leaves* paired; *blades* oblanceolate, 32.5–50 cm long, 12.5–18.5 cm wide, at apex obtuse to rounded and often with a deltoid tip ca. 5 mm long, at base tapering and acute, drying papyraceous to chartaceous, adaxially glabrous, abaxially moderately to densely puberulous throughout, the costa often purple on both surfaces; secondary veins 18–30 pairs, extending to unite in a marginal or submarginal looping collecting vein; *petioles* 2–6 cm long, glabrous; *stipules* sparsely puberulous to glabrescent, interpetiolar and also united for ca. 5 mm intrapetiolarly, 5.5–10 cm long, bilobed for ⅔–¾ of their length, the lobes ligulate to somewhat elliptic, often overlapping laterally, obtuse to somewhat acute, entire. *Inflorescences* erect, with peduncles 1.5–7 cm long; panicles spiciform to subcapitate, surrounded at base by stipules of the uppermost nodes, densely congested, 8.5–15 cm long, 5–8.5 cm diam., without developed branches, with flowers pedicellate in bracteate cymules of 5–15; bracts sparsely to moderately puberulous to pilosulous, acute, ciliolate, purple to blue-purple, those subtending cymules ovate to lanceolate, 3.5–4 × 2–3.5 cm, those subtending flowers oblanceolate to narrowly triangular or lanceolate, 2.5–5 × 4–12 mm; pedicels 3–20 mm long; *flowers* with hypanthium cylindrical, ca. 1.5 mm long, glabrous; *calyx* limb 2.5–3 mm long, glabrous, divided to base, lobes lanceolate to triangular, acute; *corolla* funnelform, cream to pale yellow sometimes flushed with rose in throat, shortly exserted from the surrounding bracts; *disk* 1–1.5 mm high. *Infructescences* similar to inflorescences; *fruits* ellipsoid, ca. 8 × 4.5 mm, glabrous; *pyrenes* with 3–4 low longitudinal ridges.

Distribution and habitat. Known only from the general region of the type collection, in wet forest at 890–1685 m.

This new species is distinguished by its rather succulent habit, relatively large, shortly petiolate leaves, relatively large, deeply bilobed stipules, and congested spiciform inflorescences with well-developed bracts. The corollas have been photographed, but unfortunately are not preserved well enough in the specimens examined to permit a complete description. This species is classified in *Palicourea* on the basis of its similarity in both vegetative and reproductive features, to the extent these are known, to other species of this genus

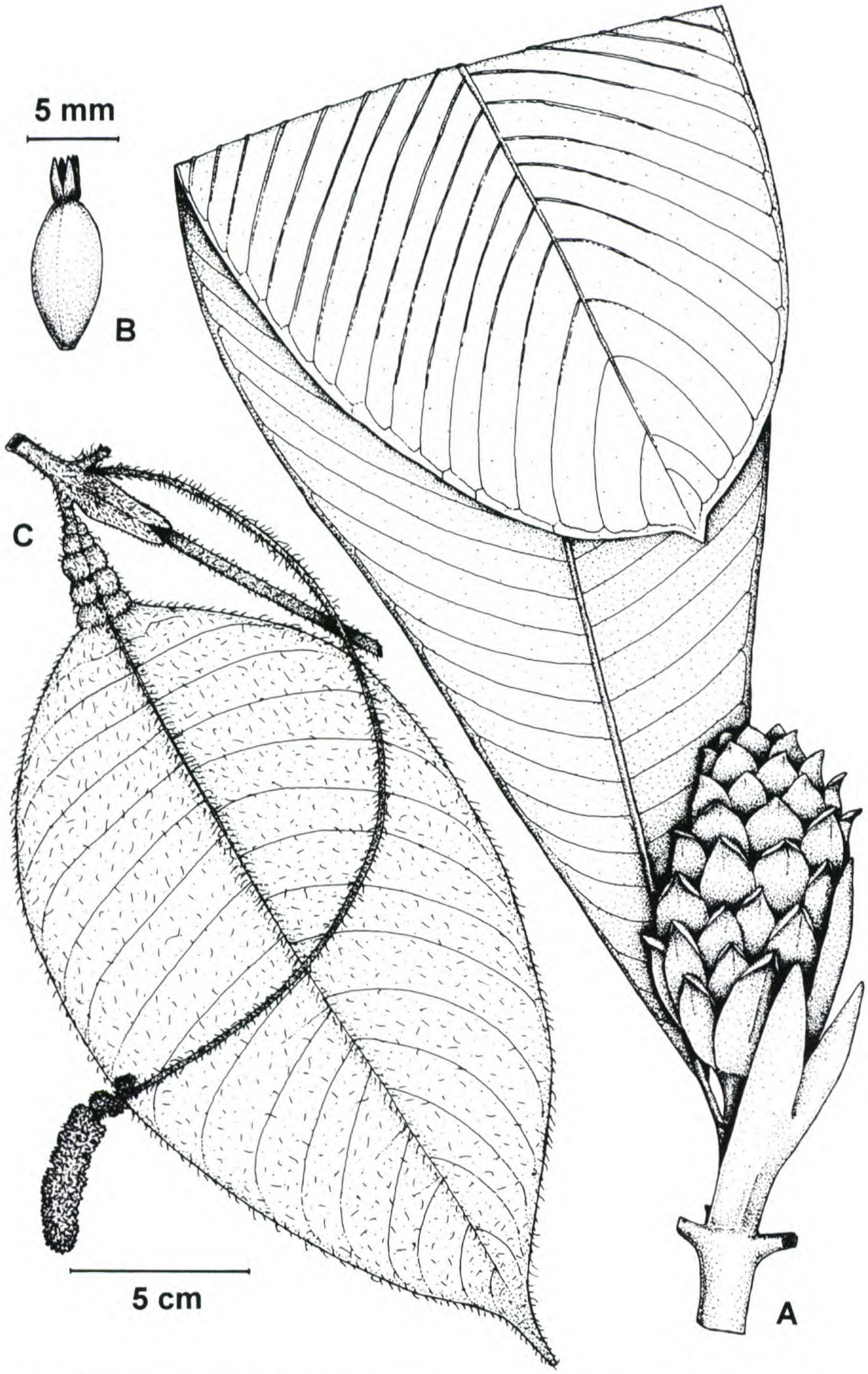

Figure 1. A, B, *Palicourea orquidea* C. M. Taylor. —A. Flowering branch. —B. Fruit. —C. *Psychotria vesciculifera* C. M. Taylor, flowering branch. A and C to 5-cm scale. A based on *Cogollo et al. 2923*; B based on *Cogollo et al. 5036*; C based on *Forero et al. 3247*.

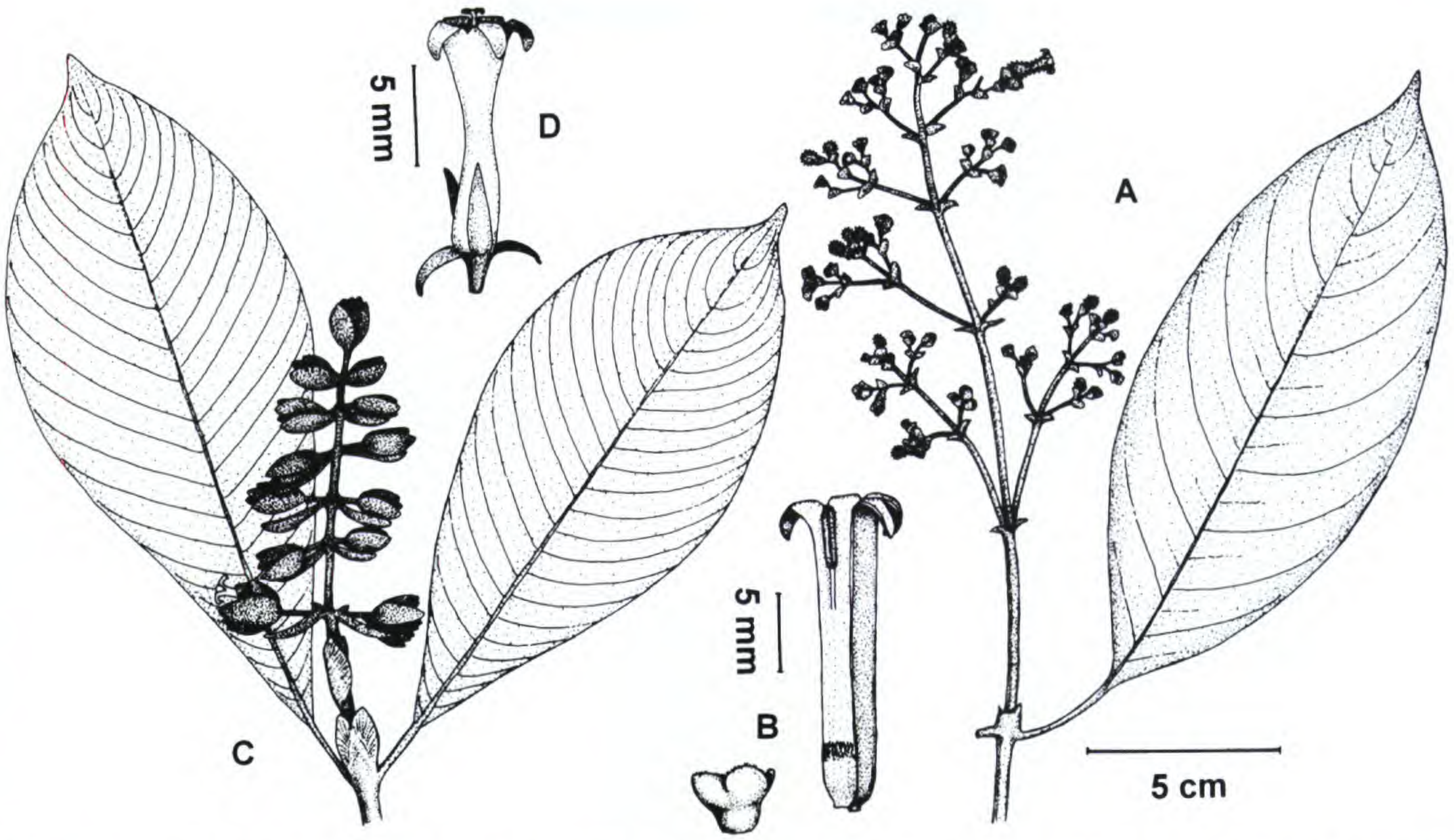

Figure 2. A, B, *Palicourea quadrilateralis* C. M. Taylor. —A. Flowering branch. —B. Calyx and corolla, partially dissected. C, D, *Palicourea sopkinii* C. M. Taylor. —C. Flowering branch. —D. Flower. A and C to 5-cm scale. A based on *Juncosa & Escobar 733*; B based on *Cogollo & Brand 349*; C, D based on *Silverstone-Sopkin et al. 1663.*

found in this region. However, the presence of the corolla features that distinguish this genus must be verified in this species to confirm its generic placement. *Palicourea orquidea* is similar to *P. acanthacea* C. M. Taylor; the latter species can be separated by its longer petioles, elliptic leaves, shorter inflorescences, and usually red-purple corollas.

The specific epithet refers to the park in which this species was found, as well as the distinctive purple color of the inflorescence bracts.

Paratypes. COLOMBIA. **Antioquia:** Parque Nacional Natural "Las Orquídeas," Sector Venados, 9°33′N, 76°19′W, *Cogollo et al. 2923* (JAUM); camino de Venados arriba hacia Carauta, margen derecha del río Venados, 6°35′N, 76°17′W, *Cogollo et al. 4037* (JAUM).

Palicourea quadrilateralis C. M. Taylor, sp. nov. TYPE: Colombia. Antioquia: municipio de San Luis, autopista Medellín–Bogotá, 2 kms de Río Claro, hacia Río Samaná, 13 Jan. 1983, *A. Cogollo & J. Brand 349* (holotype, MO-3016990; isotype, JAUM not seen). Figure 2A, B.

Species a congeneribus inflorescentia rubropurpurea bracteis floralibus satis latis et bene evolutis praedita, lobulis limbi calycini bene evoluti satis latis, corolla ex azurea purpurea externe saepe dense pubescenti, pyrenis in sectione transversali acute triangularibus fructum valde quadratum formantibus distinguenda.

Shrubs flowering at 1.5 m tall, to 8(–15) m tall; stems glabrous, often strongly quadrate with rather sharp angles. *Leaves* paired; *blades* elliptic, 9–20.5 cm long, 3–10.5 cm wide, at apex acute to somewhat acuminate with tips 5–10 mm long, at base acute to cuneate, papyraceous, adaxially glabrous, abaxially glabrous to occasionally pilosulous on blade and usually pilose at least in two lines along midrib; secondary veins 6–11 pairs, generally extending to or nearly to margins, with 1 somewhat well developed and often also 1–2(–4) weak intersecondary veins present between pairs of secondary veins; *petioles* 1–2 cm long, glabrous; *stipules* glabrous, fused around the stem into a continuous sheath 2.5–4 mm long, truncate, entire, lobes narrowly triangular to deltoid, 1.5–2.5 mm long, entire, acute. *Inflorescences* erect, with peduncles 4–9 cm long; panicles pyramidal, 5.5–13.5 cm long and 5–12 cm wide excluding corollas, generally with 3–4 pairs of branches, the basalmost often subtended by reduced leaves and the inflorescence then subject to interpretation as "tripartite," with flowers mixed sessile and pedicellate in rather congested cymules of 2–7, bracts 2–4 mm long, entire to ciliolate, those subtending primary branches 3–4 mm long, lanceolate to ligulate, obtuse, those subtending flowers ovate to orbicular, 2–3 mm long, often rather cucullate, obtuse to rounded, pedicels 0.5–4.5 mm long; peduncles, axis, branches, bracts, and pedicels glabrous to pilosulous, magenta to purple; *flowers* with hypanthium glabrous, turbinate to

hemispherical, 1–1.5 mm long; *calyx* limb glabrous, 1.5–2.5 mm long, lobed for ca. ½, lobes ovate to suborbicular, obtuse to rounded, entire to ciliolate; *corollas* tubular, purple to blue, somewhat swollen at base, generally straight there and in tube, externally glabrous to usually densely villous with slender multicellular trichomes ca. 1 mm long, internally glabrous except for a densely villous ring 1.5–2 mm wide at ca. 3 mm above base, tubes 11–13 mm long, ca. 2–2.5 mm diam. near middle, lobes narrowly triangular, 2–2.5 mm long, acute, at apex somewhat thickened adaxially; *anthers* in probable short-styled form ca. 3 mm long, positioned at top of corolla tube, included; *stigmas* not seen; disk annular, ca. 1 mm high. *Infructescences* similar to inflorescences; *fruits* subglobose, 6–7 mm diam., glabrous, drying quadrate in cross section due to the unusual pyrene shape; *pyrenes* with 3–4 sharp longitudinal ridges, the central one usually well developed and the others low or hardly developed, the entire pyrene thus strongly triangular in cross section.

Distribution and habitat. Antioquia, Colombia, in wet forest at 470–1500 m on slopes of the northern end of the Cordillera Central of the Andes; apparently frequent locally.

This species is distinguished by its magenta to purple inflorescences with the flowers sessile to shortly pedicellate, rather well-developed and broad floral bracts, well-developed calyx limb with rounded lobes, usually externally densely villous purple to blue corollas, and distinctive sharply triangular pyrenes forming strongly quadrate fruits when dry. It is similar to *Palicourea dorantha* Wernham, which can be distinguished by its well-developed pedicels and subglobose to ellipsoid fruits; to *P. toroi* Standley, which can be distinguished by its stipules 1–3 cm long with lanceolate acute lobes; and to *P. thermydri* Kirkbride, with pyrenes similar but larger, 8–9 mm long, and corollas with the tubes 15–16 mm long and ca. 5 mm in diameter.

Paratypes. COLOMBIA. **Antioquia:** municipio de San Luis, vía Medellín–Bogotá, quebrada La Tebaida, 6°08′N, 75°10′W, *Callejas et al. 4018* (HUA, MO); municipio de San Luis, carretera hacia Aquitania, a 8 km de la autopista Medellín–Bogotá, 5°53′N, 74°50′W, *Cogollo et al. 3788* (JAUM, MO); municipio de San Carlos, corregimiento Alto de Samaná, vereda Miraflores, *Fonnegra et al. 3013* (HUA, MO), *3138* (HUA, MO); municipio de San Francisco, corregimiento Aquitania, Finca "La Ilusión," *Fonnegra et al. 4100* (HUA, MO), *4149* (HUA, MO); municipio de San Luis, vereda San Pablo, quebrada Carbonera, Finca Aquelarre, 3°N, 75°06′W, *Fonnegra & Rengifo 4860* (HUA, MO); municipio de Nariño, vereda Puente Linda, margen izquierda del río Samaná, 5°34′N, 75°03′W, *Fonnegra et al. 5124* (HUA, MO); municipio de San Luis, autopista Medellín–Bogotá, sector Río Samaná–Río Claro, *Hernández et al. 274* (MO); municipio de San Luis, autopista Medellín–Bogotá, 2 km antes de La Josefina, *Hoyos & Hernández 353* (MO); municipio de San Luis, autopista Medellín–Bogotá, vereda La Josefina, camino a Palmira, *Hoyos & Hernández 451* (MO); municipio de San Luis, autopista Medellín–Bogotá, vereda La Josefina, camino del caño de Mariola hacia Santa Bárbara, *Hoyos & Hernández 644* (MO); municipio de San Luis, autopista Medellín–Bogotá, vereda La Josefina, cañón de la quebrada La Salada, *Hoyos & Hernández 874* (MO); municipio de San Luis, autopista Medellín–Bogotá, vereda La Josefina, camino hacia Filo Estrecho y Santa Elena, *Hoyos & Hernández 1009* (MO); municipio de San Luis, 8 km E of bridge over Río Caldera on main highway from Medellín, *Juncosa & Escobar 733* (MO); municipio de San Carlos, along creeks leading into the ISA hydroelectric dam reservoir, 6°00′N, 75°00′W, *McPherson 13311* (MO); municipio de San Luis, quebrada "La Cristalina," 6°N, 74°45′W, *Ramírez et al. 80* (MO), *Ramírez & Cárdenas 418* (JAUM, MO), *580* (JAUM, MO), *1803* (JAUM, MO).

Palicourea sopkinii C. M. Taylor, sp. nov. TYPE: Colombia. Chocó: municipio de San José del Palmar, Cerro del Torrá, vertiente nororiente, arriba del helipuerto, 9 Jan. 1984, *P. A. Silverstone-Sopkin, N. Paz, A. Duque & H. Bayona 1663* (holotype, MO-3230892; isotypes, CUVC, MO-3230900). Figure 2C, D.

Species a congeneribus foliis plerumque oblanceolatis nervis secundariis satis numerosis instructis, lobulis stipularum grandium imbricatis, inflorescentia pyramidali ex rosea rubroviolacea bracteis bene evolutis praedita, lobulis calycinis satis longis, corolla infundibuliformi, fructu anguste ellipsoideo distinguenda.

Shrubs flowering at 1.5 m tall, to 4 m tall; stems quadrate, rather succulent, moderately to rather densely puberulous. *Leaves* paired; *blades* elliptic or usually oblanceolate to somewhat obovate, 7.5–23 cm long, 3–8.5 cm wide, at apex acuminate with tips 2–20 mm long, at base cuneate to usually acute, chartaceous, adaxially glabrous except densely pilosulous to hirtellous on costa, abaxially puberulous to usually glabrous on lamina and puberulous to usually densely so on costa and secondary veins; secondary veins 15–25 pairs, extending to unite with margins, without intersecondary veins; *petioles* 8–25 mm long, moderately to densely puberulous; *stipules* moderately to densely puberulous, interpetiolar, elliptic to somewhat ovate, 12–23 mm long, bilobed for ⅓–½, the lobes ligulate to elliptic, overlapping laterally, obtuse to rounded, entire to usually erose. *Inflorescences* erect, with peduncles 2–4 cm long; panicles pyramidal, 6–10 cm long, 4–6 cm wide at base, with 3–6 pairs of spreading to somewhat reflexed branches, with flowers sessile in glomerules of 3–7, these 1–4 per branch; bracts glabrous, ciliolate, rose to deep pink

or red-violet, those subtending branches ligulate to elliptic or lanceolate, 15–20 × 4–5 mm, those subtending glomerules and flowers lanceolate to ovate or elliptic, 10–20 × 5–10 mm; peduncle and axis glabrous to puberulous; *flowers* with hypanthium glabrous, ca. 2 mm long, cylindrical to narrowly turbinate; *calyx* limb glabrous, divided to base, lobes triangular to narrowly lanceolate, rose to pink, 4–5 mm long, acute, entire to minutely ciliolate; *corolla* funnelform, white, a little swollen and gibbous at base, generally straight at base and in tube, externally and internally glabrous except for a pilosulous to pilose ring ca. 2 mm wide near middle of tube, tube 11–12 mm long, ca. 1.5 mm diam. near middle, lobes triangular, ca. 4 mm long, acute; *anthers* in probable long-styled form ca. 2.5 mm long, positioned in upper ¼ of tube, included, subsessile; *stigma* in probable long-styled form ca. 0.5 mm long, shortly exserted; *disk* ca. 1 mm high. *Infructescences* with branches becoming reflexed, bracts becoming blue to metallic dark blue; *fruits* narrowly ellipsoid, 4–5.5 × 3.5 mm, blue; *pyrenes* with 4–5 low rather sharp longitudinal ridges.

Distribution and habitat. Known only from the general region of the type collection, in primary cloud forest at 1900–2500 m.

This species is distinguished by its generally oblanceolate leaves with relatively numerous secondary veins and the minor venation not evident on the abaxial surface, large stipules with laterally overlapping lobes, pyramidal rose to red-violet inflorescences with well-developed bracts, relatively long calyx lobes, funnelform corollas, and narrowly ellipsoid fruits. It is similar to several other species of *Palicourea* from this same region, in particular *P. ochnoides* Dwyer and *P. killipii* Standley, both with pedicellate flowers, and *P. orquidea*, with larger leaves and stipules and the inflorescences not evidently branched. It is also similar to *Psychotria aviculoides* Kirkbride, which can be distinguished by its leaves with 12–14 pairs of secondary veins, capitate to cylindrical inflorescences, corollas not swollen at base and with the internal pubescence distributed throughout the distal ⅔ of the tube, and flattened fruits; and to *Psychotria humboldtiana* (Chamisso) Mueller Argoviensis of Venezuela, which can be distinguished by its leaves elliptic to usually lanceolate, stipules 3–8 mm long, and inflorescences with 3 glomerules of flowers in an umbelliform arrangement.

The specific epithet honors Philip A. Silverstone-Sopkin, professor in the biology department of the Universidad del Valle in Cali, discoverer of this species, and a careful and dedicated student of the flora of Valle and southern Chocó Departments, Colombia.

Paratypes. COLOMBIA. **Chocó:** municipio de San José del Palmar, Cerro del Torrá, vertientes nororiental y oriental, arriba del helipuerto, *Silverstone-Sopkin et al. 1602* (CUVC, MO), *4263* (CUVC, MO), *4960* (CUVC, MO).

Palicourea zarucchii C. M. Taylor, sp. nov. TYPE: Colombia. Antioquia: municipio de Medellín, cerro del Padre Amaya, 9.4 km from Medellín–Santa Fe de Antioquia highway on road to summit, 6°16′N, 75°41′W, 30 Mar. 1987, *J. Zarucchi & B. Echeverry 5128* (holotype, MO-4990808; isotype, HUA not seen). Figure 3A, B.

Species a congeneribus stipulis interpetiolaribus bilobis satis bene evolutis, calyce satis longo, corolla satis brevi basi inflata parum curvata, fructu anguste ellipsoideo distinguenda.

Shrubs or small trees flowering at 2 m tall, to 6 m tall; stems quadrate, glabrous or occasionally sparsely to densely pilosulous, perhaps somewhat succulent. *Leaves* paired; *blades* elliptic, 4–10.5 × 1.6–4.2 cm, at apex acute to slightly acuminate, at base acute to cuneate, chartaceous, adaxially glabrous or occasionally puberulous along costa, abaxially glabrous or sometimes puberulous to pilosulous along costa and less commonly also along secondary veins; secondary veins 7–12 pairs, generally extending to margins, with 1–2 weak intersecondary veins usually present between pairs of secondary veins; *petioles* glabrous or occasionally pilosulous, 1–12 mm long; *stipules* glabrous or occasionally sparsely to densely pilosulous, interpetiolar, a little inflated, 5–12 mm long, ovate, bilobed, lobes deltoid to triangular, 0.5–5 mm long, acute to obtuse, entire to ciliolate. *Inflorescences* erect, with peduncles 1.5–4 cm long; panicles pyramidal, 4–9 × 3.5–6.5 cm, with 3–7 pairs of branches, these sometimes closely set and appearing subverticillate, with flowers mixed sessile and pedicellate in cymules of 5–11; bracts glabrous, entire, those subtending branches narrowly triangular to narrowly elliptic, 7–14 mm long, acute to obtuse, sometimes shortly lobed at base, those subtending flowers elliptic, obtuse to rounded, 1–1.5 mm long; pedicels to 3 mm long; peduncle, axis, branches, and pedicels moderately to densely puberulous to pilosulous, pale green to yellow; *flowers* distylous, with hypanthium turbinate, glabrous to sparsely pilosulous, ca. 1 mm long; *calyx* limb glabrous, pale green, 2–3 mm long, lobed nearly to base, lobes generally narrowly ligulate, equal to somewhat unequal, acute to obtuse; *corolla* funnelform, white or

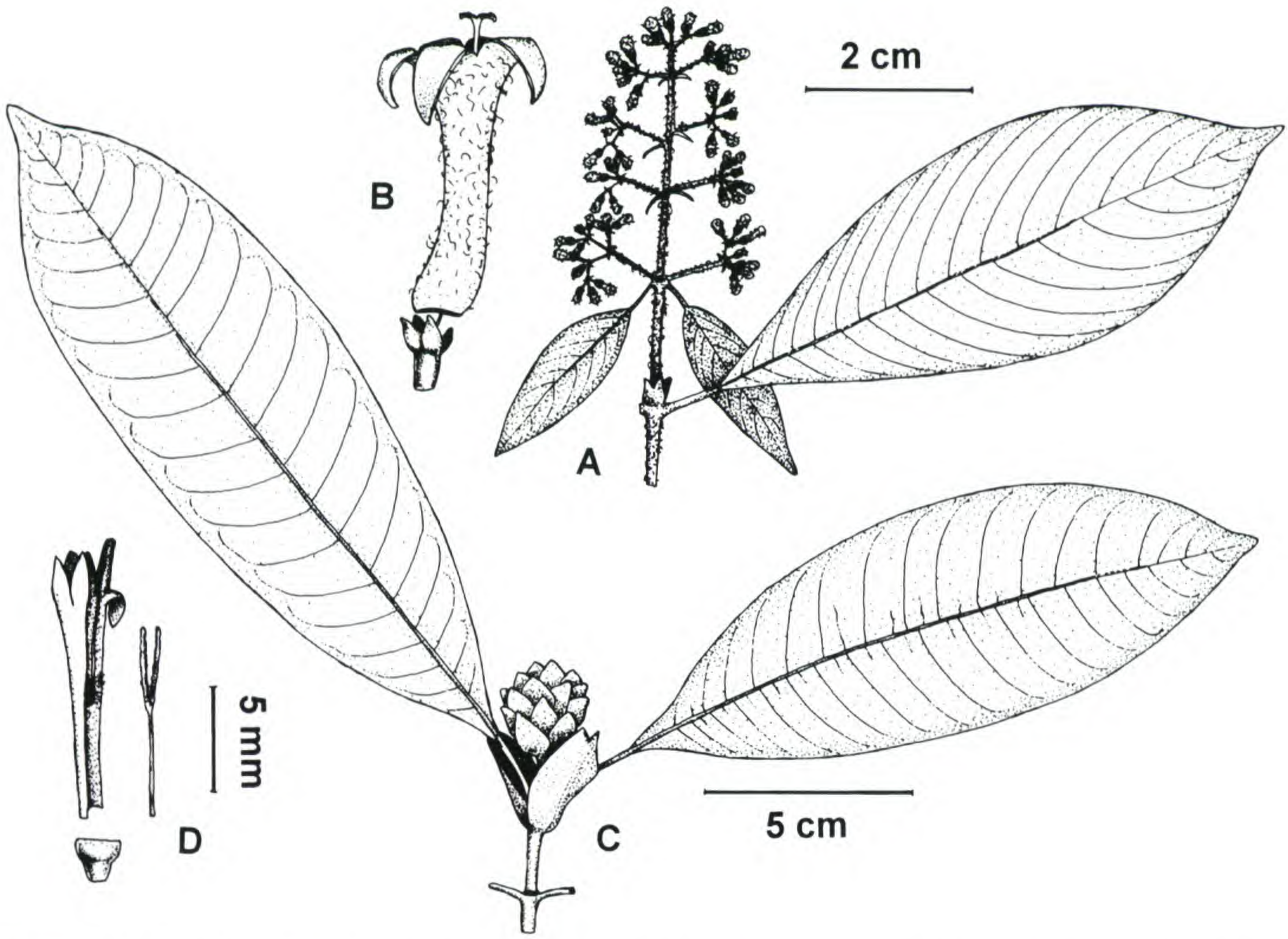

Figure 3. A, B, *Palicourea zarucchii* C. M. Taylor. —A. Flowering branch. —B. Flower, partially dissected. C, D, *Psychotria ovatistipula* C. M. Taylor. —C. Flowering branch. —D. Flower, partially dissected. B and D to 5-mm scale. A, B based on *McPherson et al. 13115*; C based on *Ramírez & Cárdenas 592*; D based on *Hernández et al. 248*.

usually cream to pale yellow, at base swollen and a little gibbous, a little bent here and curved in tube, externally moderately to densely hirsutulous with trichomes ca. 0.5 mm long, internally glabrous except for a densely villous ring ca. 2 mm wide at ca. 3 mm above the base, tube 5.5–6 mm long, ca. 1.5 mm diam. near middle, lobes 5(6), narrowly triangular to ligulate, 3–3.5 mm long, acute at apex, reflexed at anthesis; *anthers* in long-styled form subsessile, partially exserted, ca. 2 mm long, in short-styled form completely exserted on slender filaments ca. 4.5 mm long, ca. 2 mm long; *stigmas* in long-styled form ca. 1 mm long, exserted, in short-styled form ca. 2 mm long, positioned near middle of corolla tube; disk ca. 1 mm long, annular. *Infructescences* becoming flushed with purple; *fruits* narrowly ellipsoid to lanceoloid, ca. 6 × 3.5 mm; *pyrenes* with 4–5 narrow rounded longitudinal ridges.

Distribution and habitat. Antioquia and Chocó Departments, Colombia, in subparamo vegetation at 2630–3050 m in the northern end of the Cordilleras Occidental and Central of the Andes.

This species is distinguished by its relatively well-developed, interpetiolar, bilobed stipules, relatively long calyces, relatively short corollas that are swollen and a little bent at the base, and narrowly elliptic fruits. It is similar to *Palicourea pauciflora* Standley, which can be separated by its stipules 3–5 mm long, calyx lobes 4–6 mm long, and longer pale green corollas; and to *P. garciae* Standley, which can be separated by its stipules 2–5 mm long, rounded-corymbiform inflorescences, and calyx limb 0.8–1.2 mm long. The label data on one specimen, *Silverstone-Sopkin 4436*, note that the flowers and inflorescences were flushed with rose and purple, respectively. Such colors are occasionally found in several species of *Psychotria* and *Palicourea* with normally pale inflorescences and flowers, including *Palicourea garciae* (pers. obs.), usually on individuals growing exposed to full sun.

This species is named in honor of James Zarucchi, who has made many of the collections of this species.

Paratypes. COLOMBIA. **Antioquia:** municipio de Bello, corregimiento de San Félix, Cerro San Félix to Boquerón, en la vía al Cerro, 6°20′N, 75°30′W, *Callejas et al. 11546* (HUA, MO); Medellín, Mount El Boquete [sic],

Alto de los Baldíos, *Cuatrecasas et al. 24256* (MEDEL); Belmira, *Espinal 5* (MEDEL); Alto de Boquerón, Medellín, *Espinal 1185* (MEDEL); municipio de Belmira, Finca El Páramo, *Fonnegra et al. 5385* (HUA, MO), *5373* (HUA, MO); municipio de Urrao, on trail leading to Páramo de Frontino, near finca el Quince, 6°30′N, 76°10′W, *McPherson et al. 13115* (HUA, MO); municipio de Abriaquí, Parque Nacional Natural "Las Orquídeas," *Ramírez et al. 3830* (MEDEL); Cerro del Padre Amaya, a orillas de la carretera de la repetidora de T. V., Medellín, *Rivera et al. 7055* (MEDEL); 10 km al E de Sonsón, *Scolnik et al. 10An266* (MEDEL); Cerro los Baldíos, *Solano et al. 121* (MEDEL); Yarumal, *Tomás 1516* (MEDEL); municipio de Yarumal, N of Yarumal on road to Cerro Marconi, 6°59′N, 75°24′W, *Zarucchi & Cárdenas 4317* (MO); municipio de Sonsón, km 12 of road Sonsón–Nariño, 5°42′N, 75°15′W, *Zarucchi & Bedoya 4451* (HUA, MO); 25 km from Nariño, near Km 151 post, *Zarucchi et al. 5244* (HUA, MO); municipio de Medellín, Cerro del Padre Amaya, 7.5 km from Medellín–Santa Fe de Antioquia highway on road to summit, 6°18′N, 75°41′W, *Zarucchi & Madrigal 4788* (HUA, MO), 11 km from road, *Zarucchi & Madrigal 4844* (HUA, MO), 10 km from road, *Zarucchi & Madrigal 5315* (HUA, MO); municipio de Bello, vereda a San Félix, 7.6 km from Medellín–San Pedro road, on road to communication towers, *Zarucchi & Echeverri 6335* (HUA, MO). **Chocó:** municipio San José de Palmar, Cerro del Torrá, *Silverstone-Sopkin et al. 4436* (CUVC, MO).

Psychotria ovatistipula C. M. Taylor, sp. nov. TYPE: Colombia. Antioquia: municipio de San Luis, autopista Medellín–Bogotá, sector Río Samaná–Río Claro, 19 Mar. 1982, *J. J. Hernández, S. E. Hoyos & L. Albert de Escobar 248* (holotype, MO-4571898; isotype, HUA not seen). Figure 3C, D.

Species a congeneribus stipulis ovatis satis grandibus, nervis secundariis foliorum grandium adaxialiter prominentibus et abaxialiter planis vel incrassatis, inflorescentia subcapitata subsessili vel brevipedunculata bracteis bene evolutis praedita distinguenda.

Shrubs flowering at 3 m tall, to 4 m tall, glabrous throughout. *Leaf blades* elliptic to elliptic-oblong, 12.5–26.5 cm long, 3.5–7.5 cm wide, at apex acute to slightly acuminate, at base acute to cuneate, papyraceous, apparently pale abaxially; secondary veins 16–25 pairs, with 1–2 intersecondary veins usually present between pairs of secondary veins, adaxially the costa prominent and sometimes whitened, secondary veins and sometimes the intersecondary veins prominulous, and minor venation plane, abaxially the costa prominent and secondary veins and minor venation plane; *petioles* 1.5–6.5 cm long; *stipules* interpetiolar, membranaceous to papyraceous, caducous, often white or yellow or those subtending inflorescences flushed with purple, ovate in outline, sometimes costate, 20–30 × 10–22 mm, at base rounded to subauriculate, at apex shortly to distinctly bilobed, lobes 3–10 mm long, acute, entire to somewhat erose. *Inflorescences* terminal, perhaps deflexed, with peduncles 15–20 mm long; flower portion subcapitate, ellipsoid to hemispherical, 20–25 × 25–35 mm including bracts, with flowers sessile in dense bracteate glomerules, bracts lanceolate to elliptic, yellow to green or flushed with purple, obtuse to rounded, entire to somewhat erose, those subtending inflorescences and glomerules 12–14 × 7–8 mm, those subtending flowers 7–8 × 5 mm; *calyx* limb glabrous, cupuliform, ca. 1 mm long, truncate; *corolla* tubular, yellow, straight at base and in tube, externally glabrous, internally glabrous except pilosulous in a ring ca. 1–1.5 mm wide at stamen attachment and on filament bases, tube ca. 1 cm long, ca. 1 mm diam. near middle, lobes ligulate, 2.5–3 × 1 mm, acute; *anthers* in probable short-styled form ca. 3 mm long, exserted; *style* in probable short-styled form ca. 5 mm long, stigmas 2, linear, ca. 4 mm long; disk ca. 0.5 mm long, annular. *Fruit* not seen.

Distribution and habitat. In wet forest, including disturbed primary forest, at 520–900 m in northwestern Colombia.

This species is distinguished by its relatively large stipules, large leaves with the secondary veins raised adaxially and plane to thickened abaxially, and subsessile to shortly pedunculate, subcapitate inflorescences with well-developed bracts. It is similar to *Psychotria capitata* Ruiz & Pavón, a widespread variable species that can be separated by its pedunculate branched inflorescences and its narrow stipules. *Psychotria ovatistipula* is also similar in aspect to *P. humboldtiana* (Chamisso) Mueller Argoviensis of Venezuela, which can be distinguished by its inflorescences with 3–5 separate glomerules in an umbelliform arrangement. *Psychotria ovatistipula* belongs to *Psychotria* subg. *Heteropsychotria*, and probably is closely related to *P. capitata*.

Psychotria ovatistipula is known only from the local area in which the type was collected, where it is said on the label data from one collection (*Hernández & Hoyos 371*) to be rare. The fruits are described by collectors as bright green becoming white, although no fruits are represented on the specimens examined.

Paratypes. COLOMBIA. **Antioquia:** municipio de San Carlos, corregimiento de Alto de Samaná, vereda Miraflores, quebrada La Miranda, *Fonnegra et al. 2996* (HUA, MO); municipio de San Francisco, corregimiento de Aquitania, Alto de Venado (Tierra Linda), *Fonnegra et al. 4033* (HUA, MO); municipio de San Francisco, corregimiento de Aquitania, río Venado, *Fonnegra et al. 4240* (HUA, MO); municipio de San Luis, autopista Medellín–Bogotá, sector río Samaná–río Claro, *Hernández & Hoyos 371* (HUA, MO); municipio de San Luis, quebrada La

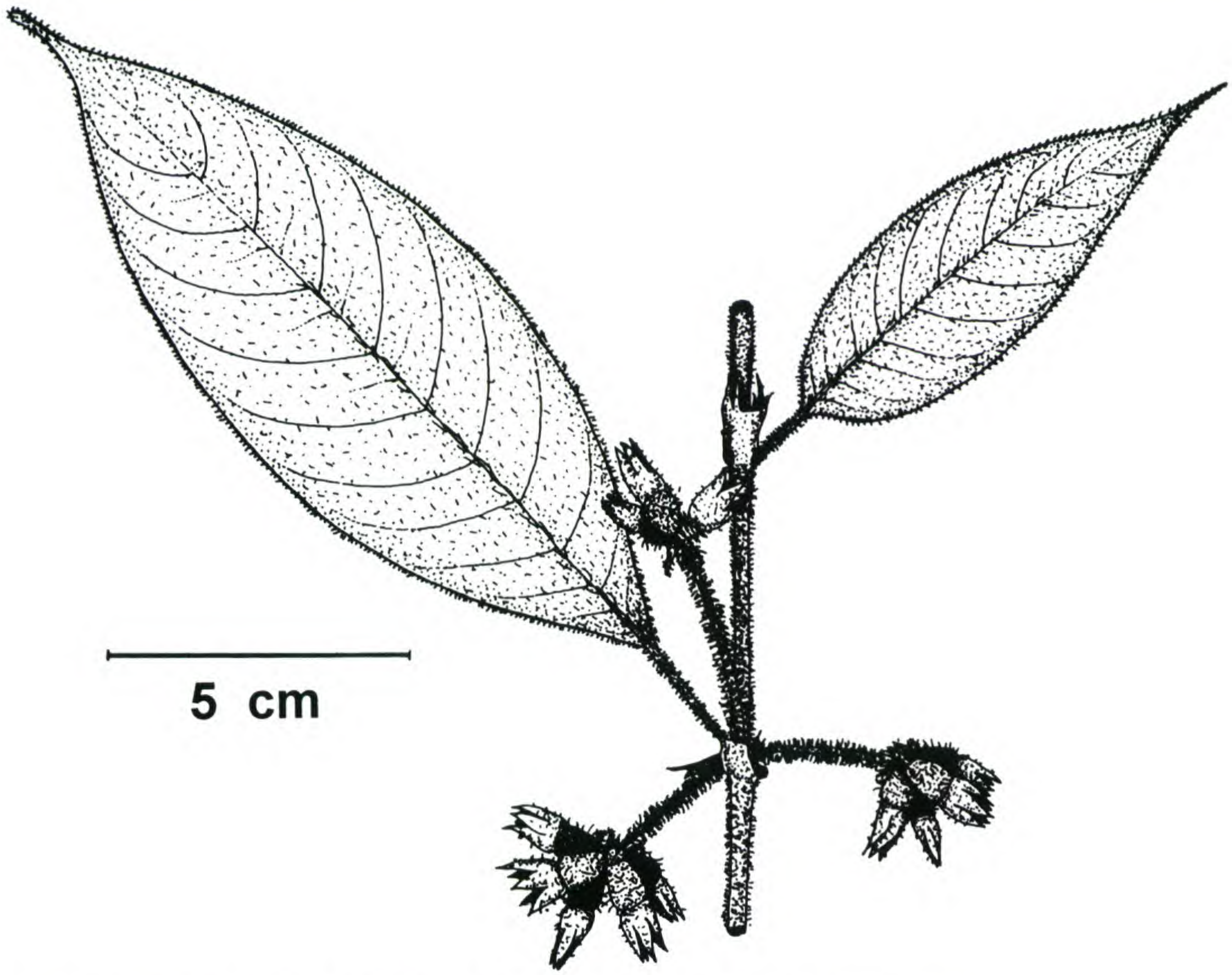

Figure 4. *Psychotria sanchezii* C. M. Taylor, flowering branch; based on *Sánchez et al. 1360.*

Cristalina, 6°N, 74°45′W, *Ramírez & Cárdenas 520* (JAUM, MO), *592* (JAUM, MO).

Psychotria sanchezii C. M. Taylor, sp. nov. TYPE: Colombia. Antioquia: municipio de Frontino, corregimiento Nutibara, cuenca alta del río Cuevas, 17 Mar. 1984, *D. Sánchez, C. Orrego, S. Sylva, G. Martínez & D. Restrepo 98* (holotype, MEDEL-28117; isotype, MO-4990809). Figure 4.

Species a congeneribus pubescentia pilosa, stipularum vaginis truncatis et lobulis fimbriatis vel erosis, inflorescentiis fasciculatis flores sessiles in glomerulis gerentibus, limbo calycino urceolato lobulato 11–19 mm longo, tubo corollino gracili ca. 20 mm longo, fructo obovoideo distinguenda.

Shrubs flowering at 2 m tall, to 4 m tall; stems quadrate, becoming terete with age, densely hirsute to pilose with trichomes 0.5–1 mm long. *Leaf blades* elliptic to elliptic-oblanceolate, 9–17 cm long, 3–6 cm wide, at apex acuminate with slender tips 1–1.5 cm long, at base cuneate, papyraceous to chartaceous, moderately to densely pilose on both surfaces, usually more densely so on costa and secondary veins on both surfaces; secondary veins 8–15 pairs, with 1–2(3) intersecondary veins usually present between pairs of secondary veins; *petioles* densely spreading-pilose, 2–3.5 cm long; *stipules* persisting with the leaves, sometimes becoming fragmented and dry with age, membranaceous, moderately to densely pilose to pilosulous, sheath 7–10 mm long, truncate, with two lobes on each interpetiolar portion, these 2–10 mm long, acute, erose to fimbriate or deeply divided with up to 2–6 projections. *Inflorescences* terminal, frequently becoming overtopped by growth from both subtending axils, fasciculate, with peduncles 2–3, 1.8–3.8 cm long, densely spreading-pilose; bracts pilose, ligulate to oblanceolate or lanceolate, acuminate to fimbriate, 5–9 mm long; *flowers* sessile in glomerules of 3–8; hypanthium ca. 2 mm long, densely spreading-hirsute with trichomes 1–1.5 mm long; *calyx* limb moderately to densely hirsutulous to pilose, green to yellowish green or flushed with blue, abaxially and adaxially moderately to densely hirstulous or pilosulous, urceolate, somewhat inflated, 11–19 mm long, lobed for ⅔–¾, lobes triangular to lanceolate, acute to acuminate; *corolla* tubular,

white, straight at base and in tube, externally glabrous in basal ¼, distally moderately to densely spreading-pilose or -hirsute with trichomes 0.5–1 mm long, internally glabrous in basal ⅓, tube ca. 2 cm long, ca. 1.5 mm diam. near middle, lobes ligulate, ca. 4 mm long, acute, reflexed at anthesis; *anthers* ca. 4 mm long, sessile, positioned in lower ¼ of tube; *stigma* lobes ca. 2 mm long, positioned ca. ⅔ of length of tube above base; disk 0.6 mm long, annular. *Infructescences* with bracts becoming scarious and reflexed; *fruits* obovoid, spreading-pilose to -pilosulous, ca. 7 × 6 mm, with calyx persistent, becoming blue to purple; *pyrenes* 2–3, with 3–5 rather sharp longitudinal ridges.

Distribution and Habitat. In wet forest at 1750–2090 m, northwestern Colombia.

This species is distinguished by its pilose to hirsute pubescence on most parts, characteristic unusual stipule morphology, unusual fasciculate inflorescences with the flowers sessile in glomerules, well-developed urceolate calyx limb, relatively long slender corolla, and obovoid fruits. It can be confused with *Palicourea standleyana* C. M. Taylor, which is known from the same region, and which can be separated by its calyx limb 3–4.5 mm long and yellow corollas that are glabrous throughout except for a densely pilose ring internally near the base.

The erose to rather fimbriate stipule lobes are similar to those found in some species of *Rudgea*, and sometimes used to characterize that genus. However, the overall stipule morphology of *Psychotria sanchezii* shows the continuous truncate sheath that is characteristic of *Psychotria* subg. *Heteropsychotria*, and the stipule lobes are fimbriate to erose but not at all glandular, as is characteristic of most species of *Rudgea*. Such erose or fimbriate stipule lobes are found in other species of *Psychotria* subg. *Heteropsychotria*, including *P. stenostachya* Standley and *P. brevicollis* Mueller Argoviensis, and this new species seems best classified in this subgenus. The fruits of *P. sanchezii* have two or sometimes three developed pyrenes, and the label notes of one collection, *Sánchez 454*, describe the ovary as "plurilocular." Several other species of *Psychotria* subg. *Heteropsychotria* characteristically have more than two pyrenes per fruit, including *P. racemosa* (Aublet) Raeuschel and *P. stenostachya*.

The relatively low position of the anthers and stigma in relation to the corolla tube seen in this species is unusual among neotropical *Psychotria* (and *Palicourea*) species. This arrangement could be interpreted as a long-styled form, but typically long-styled flowers in *Psychotria* (and *Palicourea*) species have the anthers positioned near or even above the middle of the corolla tube and the stigmas exserted.

This species is named in honor of Dário Sánchez, curator of the MEDEL herbarium and collector of its type specimen.

Two additional specimens from Chocó Department, Colombia, may be referable here. These are *Forero et al. 1362* (municipio de San José del Palmar, Portachuelo, Hacienda Barro Blanco, COL, MO) and *Forero et al. 3218* (municipio Nóvita, vereda Llanadas, ladera norte del Cerro Torrá, COL, MO). These collections were both made at lower elevations (1350 and 1000–1150 m, respectively) than the other collections of *Psychotria sanchezii*, and both differ from this new species as it is circumscribed here in having smaller leaves with shorter petioles and stipules and fewer secondary veins, apparently shorter calyces, and inflorescences with apparently one subsessile to very shortly pedunculate glomerule. Unfortunately neither specimen has adequate reproductive characters for study. Another specimen from a higher elevation in the same region, *Ramos et al. 1472* (municipio de San José del Palmar, Cerro del Torrá, 1800–1900 m), is very similar to *P. sanchezii* but also inadequate for study of reproductive characters.

Paratypes. COLOMBIA. **Antioquia:** Alto de Cuevas, 10 km W of Blanquita, 12 km W of Nutibara, *Gentry et al. 76078* (MO); municipio de Frontino, corregimiento de Nutibara, cuenca alta del río Cuevas, finca de Tulio Alvarez, *Sánchez et al. 454* (MEDEL), *1360* (MEDEL); municipio de Frontino, km 17 of road Nutibara–Murrí, 6°45′ N, 76°24′W, *Zarucchi et al. 5730* (HUA, MO), *7063* (HUA, MO).

Psychotria vesciculifera C. M. Taylor, sp. nov. TYPE: Colombia. Chocó: municipio de Nóvita, vereda Llanadas, ladera norte del Cerro Torrá, al oeste del río Surama, Alto del Oso, 22 Feb. 1977, *E. Forero, A. Gentry, A. Sugden & D. Daly 3247* (holotype, MO-2594320; isotype, COL not seen). Figure 1C.

Haec species a congeneris foliis brevipetiolatis basi laminae contracta bullataque ut videtur domatium myrmecophilum formante, stipulis satis longis, pubescentia hirsuta ex trichomatibus satis longibus omnino constante ac inflorescentia pendula spiciformi pedunculo insolenter longo insidente distinguenda.

Shrubs ca. 1 m tall; stems quadrate, moderately spreading-hirsute with trichomes 2.5–5 mm long, becoming glabrescent with age. *Leaf blades* elliptic to somewhat ovate, 21–23.5 cm long, 11–12.5 cm wide, at apex acuminate with tips 1.5–2 cm long, at base the blade rounded immediately distal to a contracted, strongly bullate portion 3–3.5 cm long

and 1 cm wide, membranaceous, adaxially sparsely pilose with scattered trichomes 2.5–4 mm long, these often somewhat denser on costa and secondary veins, abaxially paler, sparsely to moderately pilose on the costa and secondary veins, and sparsely pilosulous to glabrous on the lamina, margins ciliate; secondary veins 15–16 pairs, without intersecondary veins; *petioles* 5–10 mm long, moderately to densely pilose; *stipules* interpetiolar, persisting with the leaves, moderately to rather densely pilose, ligulate to lanceolate in outline, somewhat costate, 25–35 mm long, bilobed for ca. ¼–⅓, lobes acute to acuminate, ciliate. *Inflorescences* pseudoaxillary, pendulous; peduncles slender, ca. 20 cm long, moderately to densely hirsute with trichomes 3–4 mm long; flowering portion spiciform to subcapitate, narrowly cylindrical, ca. 6 cm long, ca. 1.5 cm diam., axis densely pilose as on peduncle, flowers sessile in sessile glomerules of 3–15, these remote at base of inflorescence becoming densely congested at apex; bracts ligulate, 3–4 mm long, glabrous, ciliolate; *calyx* limb densely hirsute externally with trichomes ca. 1 mm long, internally glabrous, ca. 1 mm long, divided to base, lobes narrowly triangular, acute; *corollas* not seen; disk ca. 0.5 mm high, annular, glabrous. *Fruit* not seen.

Distribution and habitat. Known only from the type collection, in wet forest at 1000–1150 m.

This species is distinguished by its shortly petiolate leaves with the base of the lamina contracted and bullate, forming what are apparently ant domatia, relatively long stipules, hirsute pubescence with relatively long trichomes throughout, and pendulous spiciform inflorescences borne on well-developed peduncles. The bullate leaf bases contain dead ants in the abaxial cavities. The specific epithet refers to these structures. Foliar ant domatia similar to these are also found in *Hoffmannia vesciculifera* Dwyer of Panama and Costa Rica. This is apparently the first report of such domatia in neotropical *Psychotria*. The corollas and fruits have not been seen, but are described in the label data of the type collection as white and violet, respectively.

This new species is similar to *Psychotria pilosa* Ruiz & Pavón (in its broad sense) and the related species *P. sanctae-rosae* Standley (if indeed that is distinct) in general vegetative and inflorescence aspect; both of these latter species can be distinguished by their inflorescences with well-developed branches. *Psychotria vesciculifera* is also similar to *P. gonzalagunoides* Kirkbride, which can be distinguished by its appressed trichomes less than 1 mm long on all parts of the plant. All three of these other species lack bullate foliar domatia.

Based on its persistent stipules, reportedly violet fruits, and green drying color, *Psychotria vesciculifera* belongs to subgenus *Heteropsychotria* Steyermark. The pseudoaxillary inflorescences of both *P. vesciculifera* and *P. gonzalagunoides*, which also belongs here, are unusual in this group.

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Una Especie Nueva y Descripciones Ampliadas de Dos Especies Poco Conocidas en Rubiaceae de la Región Fitogeográfica del Chocó de Colombia y Ecuador

Charlotte M. Taylor
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

Miryam Monsalve B.
A. A. 25360, Herbario, Departamento de Biología, Universidad del Valle, Cali, Valle, Colombia

RESUMEN. Se describe e ilustra la especie nueva *Rudgea grandifructa* C. M. Taylor & M. Monsalve y se amplian las descripciones de las especies poco conocidas *Psychotria megistophylla* Standley y *Rudgea colombiana* Standley. Estas especies provienen de la región fitogeográfica del Chocó, y el trabajo se basa principalmente en especímenes colectados para el inventario florístico de la región de Bajo Calima, Valle, Colombia.

ABSTRACT. The new species *Rudgea grandifructa* C. M. Taylor & M. Monsalve is described and illustrated, and expanded descriptions are presented for the poorly known species *Psychotria megistophylla* Standley and *Rudgea colombiana* Standley. All are from the Chocó phytogeographic region; this work is based on specimens collected for the floristic inventory of the Bajo Calima region, Valle, Colombia.

La región biogeográfica del Chocó (Gentry, 1982) se extiende desde la provincia del Darién, Panamá, hasta la provincia de Los Ríos en el Ecuador y comprende formaciones vegetales entre las más ricas del mundo en el número de especies por unidad de área, además de corresponder a las menos conocidas (Forero, 1989; Gentry, 1982, 1986). Durante la preparación de una flora de la región de Bajo Calima en el Departamento de Valle, Colombia, se descubrió una especie de *Rudgea* nueva a la ciencia, además de material adicional de las especies poco conocidas *Psychotria megistophylla* Standley y *Rudgea colombiana* Standley. Estas tres especies pertenecen a la tribu Psychotrieae de la familia Rubiaceae y se presentan en orden alfabético.

Psychotria megistophylla Standley, Publ. Field Columbian Mus., Bot. Ser. 7: 104. 1930. TYPE: Colombia. Valle: Santa María, Timbiquí, *F. C. Lehmann 8631* (holótipo, K no visto; isótipos, F–591544, F–604346). Figura 1.

Subarbustos, arbustos o arbolitos 0.8–2 m de alto; tallos cuadrangulares o cilíndricos, densa y finamente pubescentes con tricomas cortos y patentes. *Hojas* con láminas oblanceoladas u obovadas, 15–44 × 6–17 cm, el ápice obtuso o redondeado a truncado y a veces abruptamente acuminado, el acumen 3–4 mm de largo, atenuadas hasta una base abruptamente truncada o redondeada, papiráceas o cartáceas, la haz glabra, el envés densa y finamente pubescente o a veces glabrescente y las venas principales pubescentes; venas secundarias 36–44 pares, formando un ángulo hasta 90° con la costa, broquidódromas con las venas recolectoras rectas, iguales en desarrollo a las venas secundarias y a 2–5 mm del margen, venación de orden superior no evidente; pecíolos 5–18 mm de largo, densa y finamente pubescentes; estípulas interpeciolares, persistentes por lo menos en los 1–4 nudos más distales, densa y finamente pubescentes, ovadas, 28–45 × 16–24 mm, frecuentemente algo costadas en la parte distal, ápice acuminado y biapiculado, apículos 2–3 mm de largo. *Inflorescencias* terminales, corimbiformes, densa y finamente pubescentes en su totalidad; pedúnculo 9–24 cm de largo; panículas 10–17 × 10–18 cm, los ejes secundarios en vertícilos de 4–6, cada verticilo constituido de 2–4 ejes mayores y ascendentes y 2 menores y reflejadas, las flores en címulas subumbeliformes 2–5-floras; brácteas 0.1–1 mm de largo; pedicelos 0.5–5 mm de largo; *flores* con el hipanto elipsoide, densa y finamente pubescente, 0.3–1 mm de largo; *limbo calicino* densa y finamente pubescente, 0.5–0.8 mm de largo, truncado o 5-denticulado; *corola* infundibuliforme, blanca, exteriormente densamente pubérula, interiormente glabra, el tubo 5–6 mm de largo, ca. 1 mm de diám. hacia la mitad, los lóbulos 5, ampliamente triangulares o lanceolados, 1–1.5 mm de largo, prolongados hacía el ápice en apéndices lineares y patentes 0.5–1.5 mm de largo; *anteras* 5, ca. 1 mm

de largo, subsésiles en el ⅓ basal del tubo corolino; estigmas ca. 1 mm de largo, incluidos; disco anular, ca. 2 mm de largo. *Frutos* desconocidos.

Distribución, ecología y fenología. Bosque pluvial a 100–400 m, en la costa pacífica desde Colombia central al norte de Ecuador. Florece en febrero, abril, mayo, agosto y noviembre.

Ampliamos esta descripción debido al pobre estado de las muestras originales, sobre las cuales Standley basó su descripción. Estas solamente tienen las hojas y estípulas características, pero unas cuantas inflorescencias parciales que no muestran el arreglo diagnóstico de los ejes secundarios, además de estar en estado entre floración y el desarollo de los frutos, con las flores representadas solamente por unos hipantos pequeños y cálices viejos. Standley no presentó ningún dibujo ni mencionó los carácteres distintivos de esta especie, excepto que describió parcialmente el arreglo de la inflorescencia: "ramas basalibus verticillatis." Por estas razones completamos aquí la descripción.

Psychotria megistophylla pertenece al subgénero *Psychotria* debido a su color gris o ferrugíneo a cuando seca y sus estípulas casi no bilobuladas (Hamilton, 1989). Dentro de este subgénero esta notable especie pertenece al "Grupo # 2, *costivenia*" de Hamilton (1989). Esta especie se parece a *P. rosulatifolia* Dwyer, con que se llega a confundir; *P. rosulatifolia* se distingue por las hojas con láminas 16–28 × 4.5–8.5 cm con ápices acuminados, el acumen 15–25 mm de largo, las venas secundarias en 27–32 pares, los ejes secundarios de las inflorescencias en pares y las corolas con el tubo 2.4–4 mm de largo y barbado en la garganta. *Psychotria megistophylla* se parece además a *P. grandis* Swartz, la cual se separa por las estípulas ovadas de 10–25 mm de largo con el margen revoluto, las hojas con base aguda y sin vena recolectora y las corolas con tubos 1–2.5 mm de largo y lóbulos sin apéndices lineares, y a *P. insueta* (Dwyer) C. Hamilton, la cual se distingue por las hojas sésiles con raices adventicias en la base, los ejes secundarios de las inflorescencias en pares, su condición glabra o casi glabra y las corolas con tubos 1–2.5 mm de largo y lóbulos sin apéndices lineares.

Especímenes estudiados. COLOMBIA. **Valle:** municipio de Buenaventura, corregimiento Bajo Calima, vereda San Isidro, Km 39 of road to Bahia Málaga [sic], Zona de Explotación Forestal (Cartón de Colombia), 04°02′N, 76°58′W, *Daly et al. 6014* (CUVC); municipio de Córdoba, San Cipriano, Reserva Natural del Río Escalerete, *Devia et al. 3432* (TULV); municipio de Buenaventura, Bajo Calima, ca. 15 km N of Buenaventura, "new" Dindo area, 03°59′N, 77°02′W, *A. Gentry et al. 56761* (CUVC, MO); municipio de Buenaventura, Bajo Calima, Concesión Pulpapel/Buenaventura, Carretera Nacional, 03°55′N, 77°W, *Monsalve 3188* (CUVC, MO); municipio de Buenaventura, Bajo Calima, Concesión Pulpapel, *van der Werff & Monsalve 9652* (CUVC). ECUADOR. **Carchi:** trail along plain above Tobar-Donos and to Río Guape, 01°10′N, 78°18–31′W, *Hoover 1223* (MO).

Rudgea colombiana Standley, Publ. Field Columbian Mus., Bot. Ser. 7: 152. 1930. TYPE: Colombia. Valle: Timbiquí, *F. C. Lehmann B. T. [Brother Thomas] 758* (holótipo, K no visto; isótipo, F–591556, F–604347, NY no visto). Figura 2.

Arboles 2–14 m de alto; tallos cuadrangulares o cilíndricos, glabros. *Hojas* con láminas elípticas, 8–20 × 4–10 cm, el ápice agudo u obtuso y normalmente acuminado, el acumen 5–10 mm de largo, la base cuneada u obtusa, coriáceas, la haz glabra y muy lustrosa, el envés glabro y opaco; venas secundarias en 6–8 pares, ascendentes, broquidódromas por lo menos en la parte distal, la costa y las venas secundarias planas o algo sulcadas por la haz y prominentes por el envés, venación de orden superior plana por ambos lados; pecíolos glabros, 5–30 mm de largo; estípulas glabras, persistentes o decíduas por fragmentación debajo de los 4–5 nudos más distales, fusionadas alrededor del tallo en una vaina truncada 2–6 mm de largo, con dos grupos densos de apéndices lineares 1–1.2 mm de largo a cada lado, los apéndices glandulares y caducos. *Inflorescencias* terminales, piramidales, densa y finamente pubérulas en su totalidad; pedúnculos 1–2 cm de largo; panículas 4–10 × 3–10 cm, con 3–4 pares de eje secundarias, las flores en glomérulos densos, sésiles o subsésiles, 5–20-floros; brácteas florales 0.5–3 mm de largo; *flores* con hipanto glabro o pubérulo, turbinado, 0.5–1 mm de largo; *limbo calicino* glabro, ca. 0.5 mm de largo, subtruncado o 5-denticulado, a veces ciliolado; *corola* tubular o hipocrateriforme, blanco-verdosa o amarillo-verdosa, glabra excepto densamente barbada en la garganta, el tubo 1–2 mm de largo, recto o algo urceolado, ca. 1.5 mm de diám. hacia la mitad, los lóbulos 5, ampliamente triangulares, ca. 2.5 mm de largo, agudos; *anteras* ca. 1 mm de largo, parcialmente exsertas; estigmas lineares, ca. 1 mm de largo, exsertos; disco subgloboso, ca. 0.8 mm de alto. *Frutos* elipsoides, 8 × 7–8 mm, en la madurez rojos o morados, lisos, algo suberosos.

Distribución, ecología y fenología. Bosque pluvial a 100 m, cerca de Buenaventura en la costa pacífica del departamento de Valle, Colombia. Colectada con flores en octubre, septiembre y noviembre y con frutos en junio y noviembre.

Ampliamos esta descripción debido al pobre estado de las muestras originales, sobre las cuales Standley basó su descripción. Estas solamente ti-

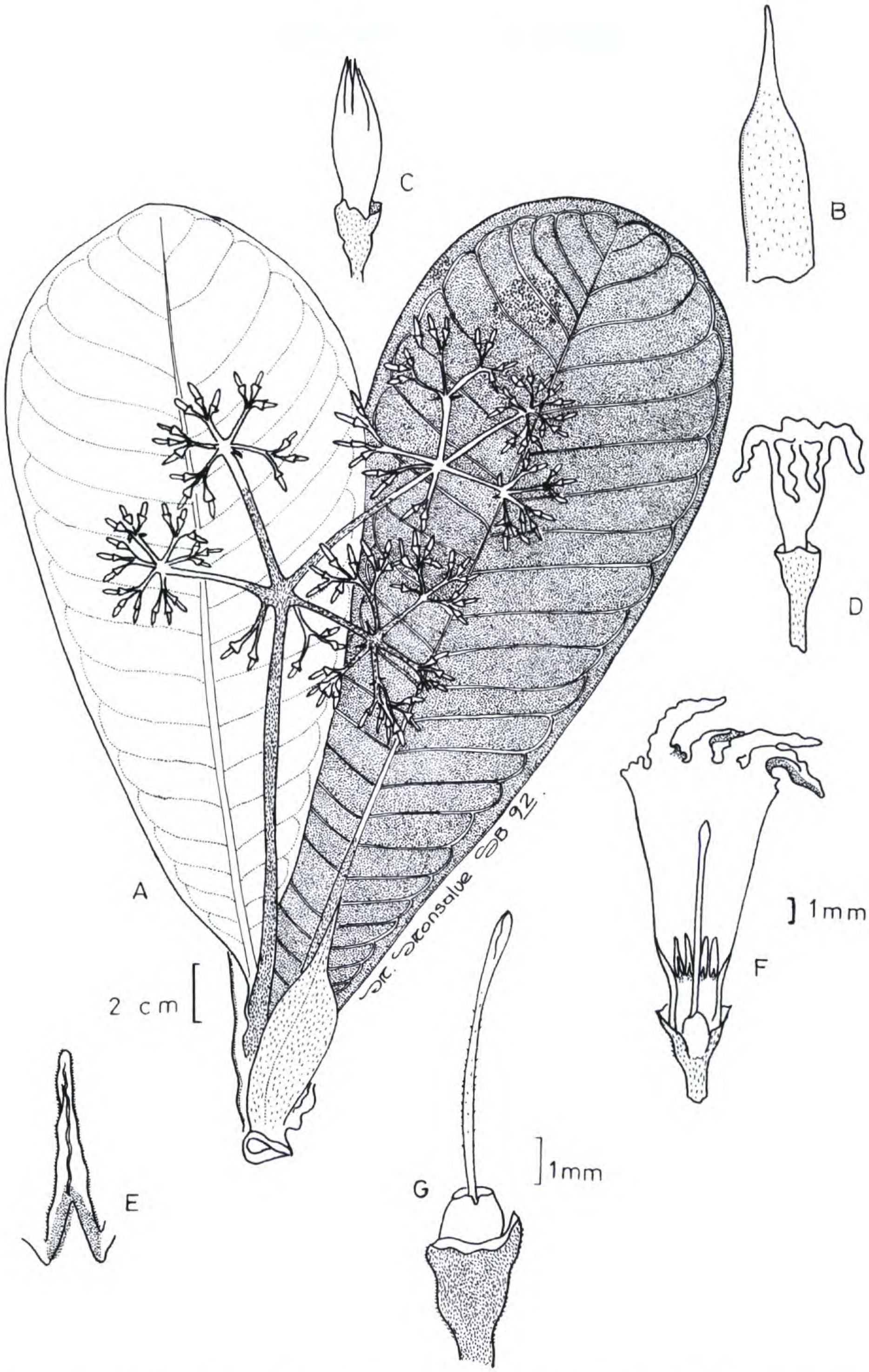

Figura 1. *Psychotria megistophylla* Standley. —A. Hábito. —B. Estípula. —C. Botón floral. —D. Flor en antesis. —E. Lóbulo de la corola. —F. Corte longitudinal de la flor. —G. Gineceo y disco. De *Monsalve 3188*; A, B a la escala de 2 cm; C, D, F a la misma escala; E, G a la misma escala.

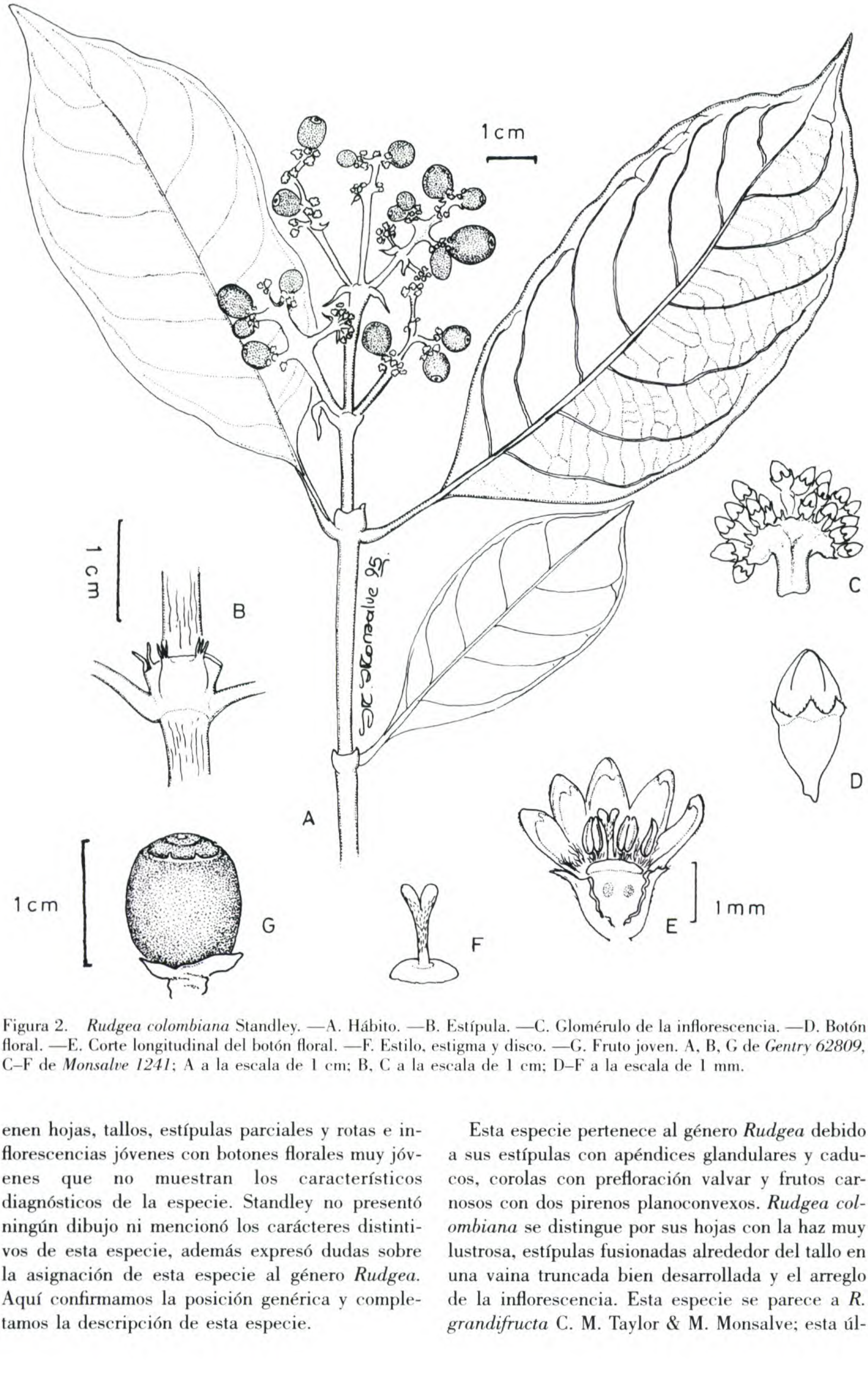

Figura 2. *Rudgea colombiana* Standley. —A. Hábito. —B. Estípula. —C. Glomérulo de la inflorescencia. —D. Botón floral. —E. Corte longitudinal del botón floral. —F. Estilo, estigma y disco. —G. Fruto joven. A, B, G de *Gentry 62809*, C–F de *Monsalve 1241*; A a la escala de 1 cm; B, C a la escala de 1 cm; D–F a la escala de 1 mm.

enen hojas, tallos, estípulas parciales y rotas e inflorescencias jóvenes con botones florales muy jóvenes que no muestran los característicos diagnósticos de la especie. Standley no presentó ningún dibujo ni mencionó los carácteres distintivos de esta especie, además expresó dudas sobre la asignación de esta especie al género *Rudgea*. Aquí confirmamos la posición genérica y completamos la descripción de esta especie.

Esta especie pertenece al género *Rudgea* debido a sus estípulas con apéndices glandulares y caducos, corolas con prefloración valvar y frutos carnosos con dos pirenos planoconvexos. *Rudgea colombiana* se distingue por sus hojas con la haz muy lustrosa, estípulas fusionadas alrededor del tallo en una vaina truncada bien desarrollada y el arreglo de la inflorescencia. Esta especie se parece a *R. grandifructa* C. M. Taylor & M. Monsalve; esta úl-

tima se distingue por las estípulas similares pero con dos dientes lineares insertas debajo del margen, el pedúnculo más corto, el limbo calicino más largo y los frutos más grandes.

Especímenes estudiados. COLOMBIA. **Valle:** municipio de Buenaventura, corregimiento San Isidro, Reserva INDERENA-CONIF, *Devia & Prado 2612* (TULV), *2637* (TULV); municipio de Buenaventura, Bajo Calima, Lijal-Gasolina road bifurcation, SSW of San Isidro, 03°57′N, 77°W, *Gentry et al. 57006* (CUVC, MO), *62809* (COL, CUVC, JAUM, MO), *62854* (CUVC, MO), *62893* (CUVC, MO); municipio de Buenaventura, Bajo Calima, Concesión Pulpapel/Buenaventura, 03°55′N, 77°W, *Monsalve 406* (COL, CUVC, JAUM, MO), *483* (COL, CUVC, JAUM, MO), *504* (MO), *547* (COL, CUVC, JAUM, MO), Concesión Pulpapel/Buenaventura, carretera La Gasolina, *Monsalve B. 1337* (COL, CUVC, JAUM, MO); Concesión Pulpapel/Buenaventura, Carretera El Lijal, *Monsalve 1241* (COL, CUVC, JAUM, MO); Concesión Pulpapel/ Buenaventura, Carretera La Gasolina, *Monsalve 1689* (CUVC, MO), *1954* (CUVC, JAUM, MO).

Rudgea grandifructa C. M. Taylor & M. Monsalve, sp. nov. TYPE: Colombia. Valle: municipio de Buenaventura, Bajo Calima Concession, road to Juanchaco Palmeras, 03°55′N, 77°02′W, 50 m, 19 July 1984, *A. Gentry, M. Monsalve y H. Mazuero 48331* (holótipo, CUVC; isótipo, MO–4566786). Figura 3.

Haec species a congeneris fructu sat grandi, foliis insolenter rigidis ac supra lucentibus, stipulis circum caulem connatis in vaginam truncatam continuam dentes bene evolutos sub margine supero insertos gerentem atque inflorescentia ex ramulis brevibus paucis flores in glomerulos densos gerentibus constante distinguitur.

Arboles 10–20 m de alto; tallos cuadrangulares, glabros. *Hojas* con láminas elípticas o algo obovadas, 15–27 × 7.5–15.5 cm, el ápice obtuso o redondeado y normalmente abruptamente acuminado, el acumen 5–12 mm de largo, la base cuneada u obtusa, coriáceas, la haz glabra y lustrosa, el envés diminutamente adpreso-pubérulo; venas secundarias en 7–9 pares, ascendentes, broquidódromas por lo menos en la parte distal, la costa y las venas secundarias planas o algo sulcadas por la haz y prominentes por el envés, la venación de orden superior plana por la haz y plana o ligeramente prominente por el envés; pecíolos glabros, 1–2.5 cm de largo; estípulas glabras, persistentes o decíduas por fragmentación debajo de los 2–4 nudos más distales, fusionadas alrededor del tallo en una vaina truncada 3–7 mm de largo, a veces con apéndices lineares 1–1.5 mm de largo en el margen, con 2 dientes lineares 2.5–4 mm de largo a cada lado, insertos debajo del margen de la vaina, en el ápice con un grupo denso de apéndices lineares de 1–1.2 mm de largo, estos últimos glandulares y frecuentemente caducos. *Inflorescencias* terminales, piramidales, densa y finamente adpreso-pubérulas; pedúnculos 3–8 mm de largo; panículas 3–9 × 3.5–10.5 cm con 1–3 pares de ejes secundarios, las flores en glomérulos densos, sésiles o subsésiles, 5–15-floros; brácteas florales 2–3 mm de largo; *flores* con hipanto pubérulo, turbinado, ca. 1 mm de largo; *limbo calicino* 1–1.5 mm de largo, 5-dentado, campanulado, exteriormente diminutamente adpreso-pubérulo, interiormente glabro; *corola* en botón campanulada, verdosa, exteriormente densa y diminutamente adpreso-pubérula, densamente barbada en la garganta, el tubo ca. 1 mm de largo, 1.5–2 mm de diám., los lóbulos 5, ampliamente triangulares, 4–5 mm de largo, agudos; *anteras* ca. 1.5 mm de largo; estilo ca. 1.5 mm de largo, pubérulo; disco subgloboso, ca. 0.5 mm de alto. *Frutos* elipsoides o algo oblongos, 3–3.5 × 2–2.5 cm, a la madurez amarillos, lisos, suberosos.

Distribución, ecología y fenología. Bosque pluvial a 50–100 m, cerca de Buenaventura en la costa pacífica del departamento de Valle, Colombia. Colectada con flores en julio y con frutos en enero, abril y agosto.

Esta especie nueva pertenece al género *Rudgea* debido a las mismas características que se mencionan para *R. colombiana*. *Rudgea grandifructa* se distingue de todas las otras especies de *Rudgea* por los frutos grandes, a los cuales se refiere el epiteto, además por las hojas con la haz lustrosa, estípulas fusionadas alrededor del tallo en una vaina truncada bien desarrollada con dientes relativamente alargados e insertos debajo del margen y por el arreglo de la inflorescencia. Esta especie nueva se parece a *R. colombiana*; las características que las diferencian se presentan arriba en la discusión de esta otra especie.

Parátipos. COLOMBIA. **Chocó:** new road being built from S of Yuto to Lloro, *Gentry & Fallen 17357* (MO); Pan American Highway ca. 10 km W of Las Animas, *Gentry & Rentería 24056* (MO). **Valle:** municipio de Buenaventura, Bajo Calima, Concesión Pulpapel/Buenaventura, 03°55′N, 77°W, *Gentry 56827* (CUVC), *Monsalve 1458* (COL, CUVC, JAUM, MO).

Agradecimientos. Nuestros más sinceros agradecimientos a la empresa Smurfit Cartón de Colombia por financiar el estudio de la flora de la región de Bajo Calima y proporcionar facilidades en el trabajo de campo, el cual se inició bajo la dirección del fallecido Alwyn H. Gentry; R. E. Gereau preparó el texto latino; J. Ramos y P. Silverstone-Sopkin de la Universidad del Valle colaboraron en la parte científica.

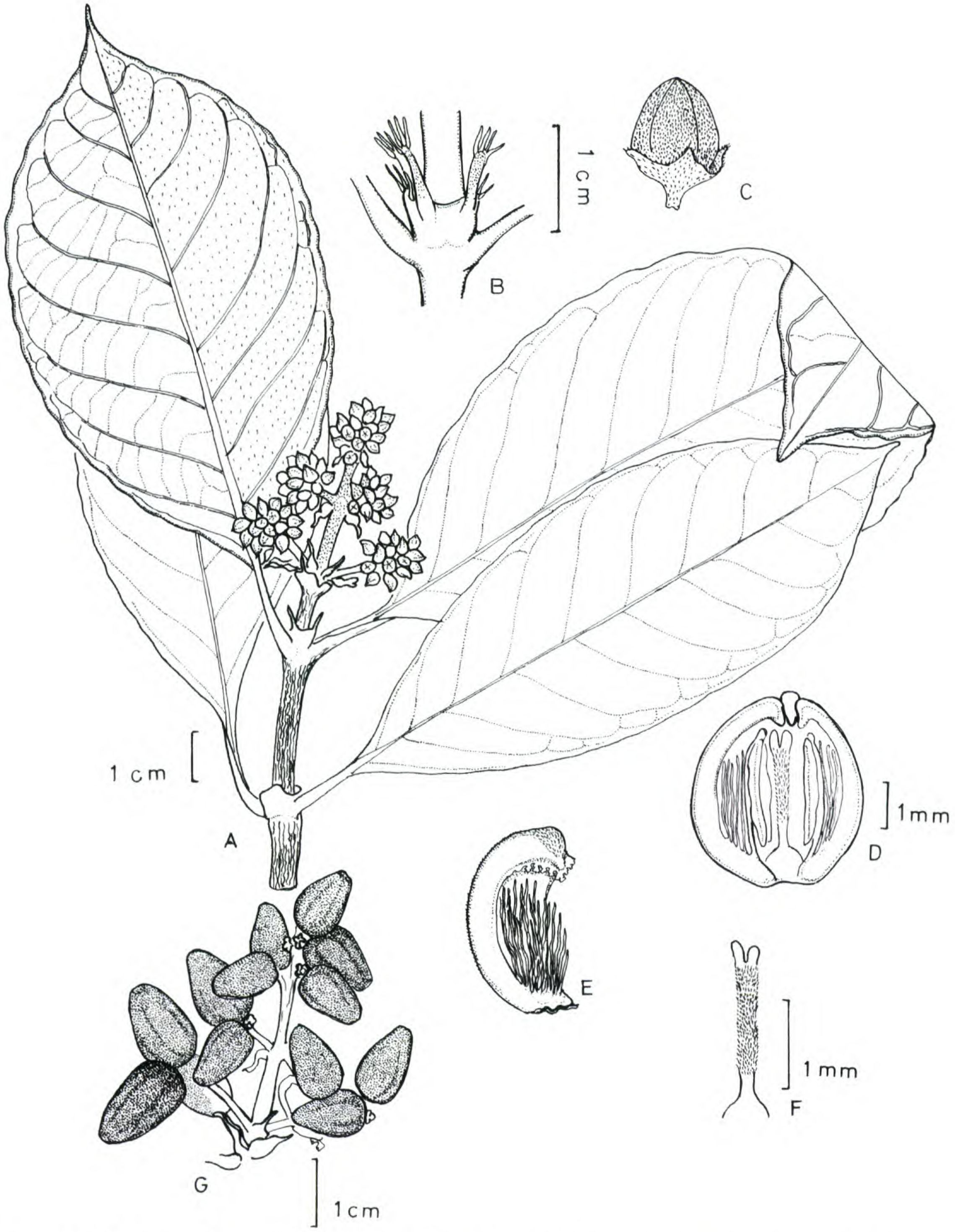

Figura 3. *Rudgea grandifructa* C. M. Taylor & M. Monsalve. —A. Hábito. —B. Estípula. —C. Botón floral. —D. Corte longitudinal del botón floral. —E. Segmento del botón floral. —F. Estilo y estigma. —G. Porción de la infructescencia con frutos. A–F de *Gentry 48331*, G de *Monsalve 1403*; A a la escala de 1 cm a su lado; B a la escala de 1 cm a su lado; C–E a la escala de 1 mm; F a la escala de 1 mm a su lado; G a la escala de 1 cm a su lado.

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Additions to Flora Mesoamericana: A New Species of *Dioscorea* (Dioscoreaceae) from Panama

Oswaldo Téllez-Valdés
Herbario Nacional, Instituto de Biología UNAM, Apartado Postal 70-367, 04510 México, D.F.

ABSTRACT. *Dioscorea davidsei*, a new species from Panama, is described and illustrated, and its relationships are discussed. The new species is distinguished from *D. megalantha*, *D. furcata*, *D. hieronymi*, and *D. sellowiana*, sect. *Cycladenium* from South America, by its sessile and conspicuously open and patent perianth.

As part of the monographic study of the genus *Dioscorea* L. for southeastern Mexico and Central America finished in 1994 (Téllez & Schubert, 1994), several species were not included because material of both sexes was lacking. Attempts to obtain both male and female collections during fieldwork in Panama were not successful. Consequently, even though the material is still not complete I decided to publish this species.

Dioscorea davidsei O. Téllez, sp. nov. TYPE: Panama. Comarca de San Blas: Cerro Brewster, headwaters of Río Cangandí, 09°18′N, 79°16′W, elev. 2600 ft., tropical wet forest, 24 Apr. 1985, *G. de Nevers, H. Herrera, B. Hammel & S. Charnley 5486* (holotype, MO; isotypes, MEXU, PMA not seen). Figure 1.

Caules dextrorsum volubiles. Folia 6.5–11.0 cm longa, 3.0–6.6 cm lata, 7-nervata. Inflorescentiae staminatae spicatae 9.0–18.0 cm usque longae. Flores rubri, sessiles; stamina 3, centralia, saepe disco carnosa inserta; antherae antrorsae, distinctae; pistillodia nulla. Inflorescentiae pistillatae ignota.

Dextrorse, climbing stems, lineate to sulcate. Leaves 6.5–11.0 cm long, 3.0–6.6 cm wide, alternate, ovate to ovate-lanceolate, 7-nerved, semichartaceous, the base cordate, the apex abruptly acuminate; petioles 1.0–3.0 cm long, slightly angulate, glandular-like. Staminate inflorescences 1–2 spikes 9.0–18.0 cm long, axilar; rachis angulate, sulcate, dentate-serrulate; external bract ca. 2.0 mm long, ca. 0.5 mm wide, linear-lanceolate to lanceolate; internal bract ca. 1 mm long, ca. 0.5 mm wide, lanceolate. Flowers 1 per bud, sessile; perianth ca. 2.5 mm, maroon; tepals 2.0–2.5 mm long, 1.0–1.5 mm wide, ovate, oval to triangular, patent; stamens 3, sessile, the anthers antrorse, the thecae coherent, inserted in a flat, transversally oblong to subquadrate carnosity, located in the center of the receptacle and joined to a circular and central fleshy disc; pistillode lacking. Pistillate inflorescences unknown.

Distribution. *Dioscorea davidsei* is endemic to the southernmost portion of Mesoamerica in Panama. It occurs in tropical rainforest, at an altitude of ca. 2600 m. Flowering occurs in April.

Dioscorea davidsei probably belongs to section *Cycladenium* Uline, subgenus *Helmia* (Kunth) Bentham, by virtue of its three stamens, all joined in a fleshy disc; however, the lack of seeds makes it impossible to establish its subgeneric placement with certainty. *Dioscorea davidsei* seems to be related to *D. megalantha* Grisebach, *D. furcata* Grisebach, *D. hieronymi* Knuth, and *D. sellowiana* Uline ex Knuth, but can be distinguished from all other species in the section by the sessile flowers and the conspicuously open and patent perianth.

Dioscorea davidsei fits within the Mesoamerican species that have three stamens (Téllez & Schubert, 1994). It is characterized by its staminate flowers, sessile stamens that are inserted in a fleshy disc, and the ovate to ovate-triangular tepals. In contrast, *D. convolvulacea* Schlechtendal & Chamisso has pedicellate staminate flowers, stamens with long filaments, and oblong to lanceolate tepals. On the other hand, *D. davidsei* has simple spikes, while in *D. standleyi* C. Morton, *D. racemosa* (Klotzsch) Uline, and *D. lepida* C. Morton the inflorescences are racemes or panicles of cymes.

The specific epithet is dedicated to Gerrit Davidse, Missouri Botanical Garden, for financial and academic support, help, and friendship during several visits to MO.

Acknowledgments. I thank María Rosa Martínez for the drawing of this species.

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Téllez V., O. & B. G. Schubert. 1994. Dioscoreaceae. Pp. 54–65 *in:* G. Davidse, M. Sousa S. & A. O. Chater (editors), Flora Mesoamericana, Vol. 6, Alismataceae a Cyperaceae. Universidad Nacional Autónoma de México, México D.F.; Missouri Botanical Garden, St. Louis; The Natural History Museum, London.

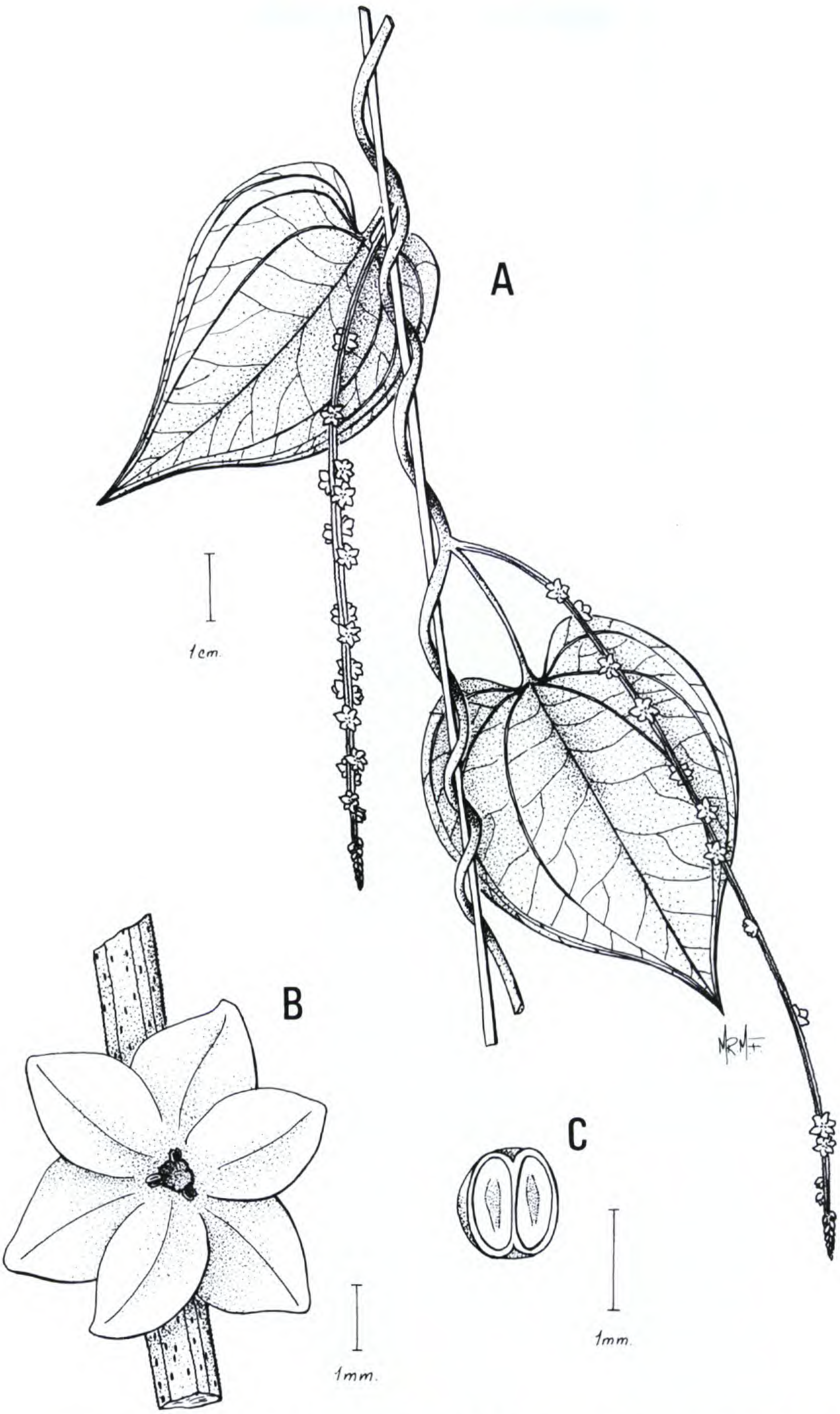

Figure 1. *Dioscorea davidsei* O. Téllez. —A. Staminate plant habit, showing the dextrorse stems and the staminate spikes. —B. Detail of staminate flower, showing the position of the stamens . —C. Detail of the anther. All from *G. de Nevers et al. 5486.*

Passiflora loefgrenii (Passifloraceae), a New Species in Subgenus *Passiflora* from the Brazilian Atlantic Rainforest

Fabio A. Vitta

Dept. Botânica, IB-Universidade de São Paulo, C.P. 11461-05422-970, São Paulo, SP, Brazil.
Present address: Dept. Botânica, IB-C.P. 6109 Universidade Estadual de Campinas, 13083-970, Campinas, SP, Brazil

ABSTRACT. A new species of *Passiflora* from the Brazilian Atlantic rainforest in the state of São Paulo is described and illustrated. *Passiflora loefgrenii* is placed in subgenus *Passiflora* "series" *Lobatae*. It is vegetatively similar to *P. amethystina* Mikan and *P. eichleriana* Masters, the three species occurring sympatrically. *Passiflora loefgrenii* differs from these species primarily by flower character. At the type locality *Passiflora loefgrenii* is pollinated by hermit hummingbirds and large bees.

The Passifloraceae were last studied comprehensively by Killip (1938). In his work, 45 species in subgenus *Passiflora* (subg. "*Granadilla*" sensu Killip) were described as occurring in Brazil. The subgenus *Passiflora* usually has large and verticillate floral bracts, showy flowers with campanulate or short-tubular calyx tubes, and coronas with at least three series of appendages. In recent studies, six new species of subgenus *Passiflora* have been described from Brazil (Sacco, 1966a, b, 1968, 1973, 1980).

Fieldwork at "Fazenda Intervales" (now Intervales State Park) in 1991 yielded the new species described here. Intervales State Park (Fig.1) is a 46,000-ha reserve in the state of São Paulo, Brazil, and, along with Carlos Botelho, Alto do Ribeira, and Xitué reserves, comprises more than 130,000 ha of continuous Atlantic rainforest in the Serra de Paranapiacaba. While examining *Passiflora* collections at the SP herbarium, I found a specimen collected in 1894 by Albert Loefgren on the margins of the Ribeira River, situated in the lowlands in the vicinity of the reserves cited above. Nowadays the Ribeira region is mostly occupied by extensive plantations. This plant, identified by H. Harms as *P. amethystina*, belongs in fact to the new species collected in 1991 at Intervales.

The new species is dedicated to Albert Loefgren, the Swedish naturalist who worked in Brazil for 44 years and first collected this plant.

Passiflora loefgrenii Vitta, sp. nov. TYPE: Brazil. São Paulo: Guapiara, Fazenda Intervales, estrada Sede–Carmo, na beira da mata, Sep. 1991, *F. A. Vitta & L. C. Passos 010* (holotype, SPF; isotypes, K, UEC). Figure 2.

Passiflora ad "series" *Lobatae* pertinens; stipulae reniformes; glandulis nectariferis stipitatis sex per paria dispositis instructus; lamina trilobata, lobis ovatis; pedunculi 11–20 cm longi; bracteae ellipticae, verticillatae; flores speciosi 9–11 cm diam.; hypanthium campanulatum; sepala extus vinosa, intus purpurea, manifeste

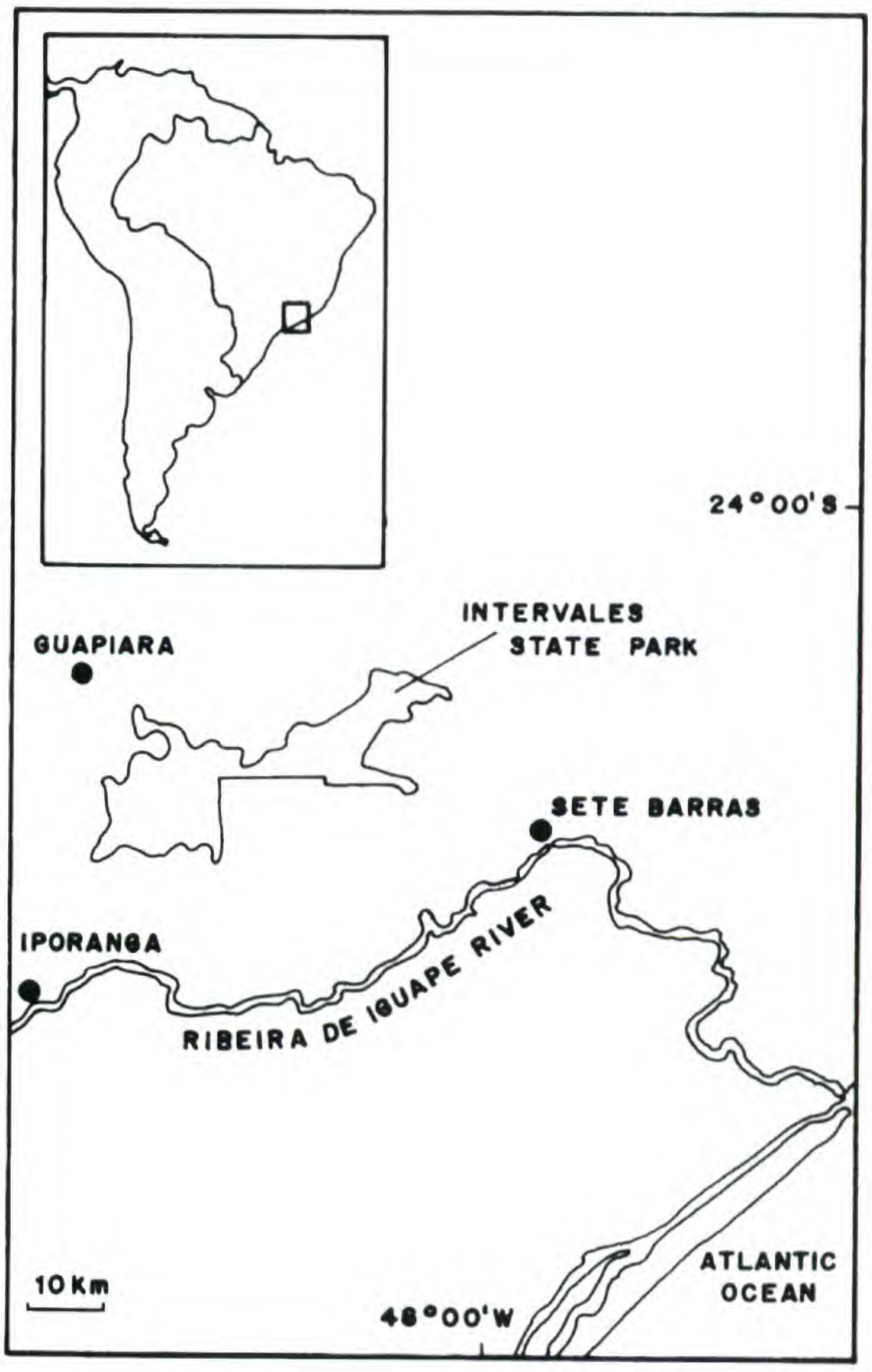

Figure 1. The Ribeira region in São Paulo showing Intervales State Park, which is situated at the Serra de Paranapiacaba.

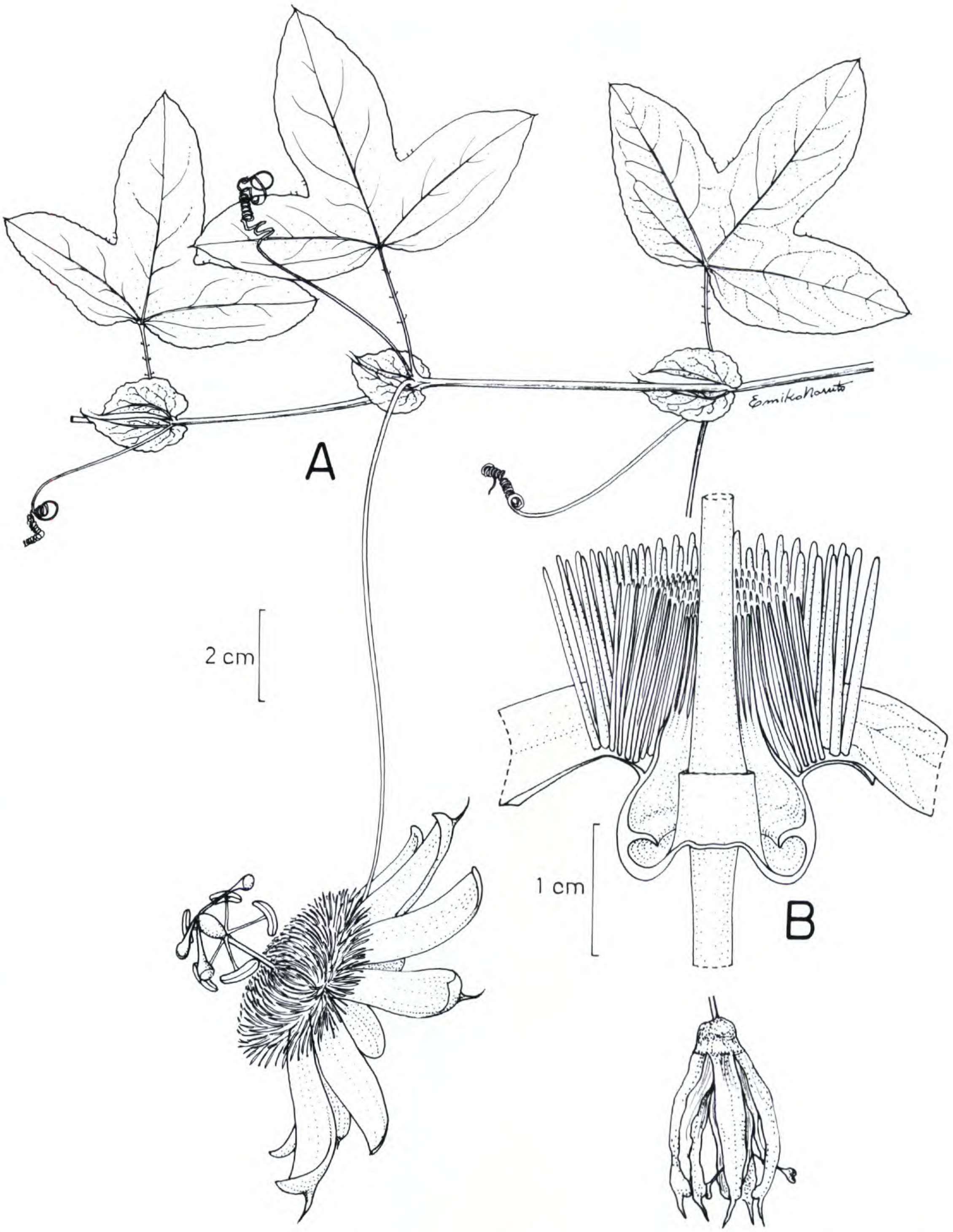

Figure 2. *Passiflora loefgrenii* Vitta. —A. Flowering shoot. —B. Longitudinal section of flower base. Drawn from *Vitta & Passos 010* (holotype).

carinato-aristata; petala purpurea; coronae filamenta 6–7 seriata, seriebus externibus duo 1.7–2.0 cm longis, internibus 1.0–1.2 cm longis, operculum modice plicatum, erectum; gynophorum 3–3.5 cm longum; ovarium glaucum, glabrum.

Vine. Plant glabrous throughout. Stems striate, terete. Stipules reniform, (0.5–)1–1.5 cm long, (0.8–)2–3.5 cm wide, glandular serrate at base, apiculate. Petioles (2–)3–7 cm long, with 3 pairs of

stipitate, subopposite nectaries 1–2 mm long. Leaf blades 3-lobed to ca. ⅓ their length, (5–)7–9.5 cm long, (5.5–)8–14 cm wide, subpeltate, cordate at base, with 2–4 stipitate nectaries at each lobe sinus; leaf lobes ovate, mucronate, lateral ones (2.5–)3.5–5 cm long, (1.3–)2.5–4 cm wide, divergent from mid lobe ca. 75°–90°, this (3–)5–6 cm long, (1.2–)2.5–4.5 cm wide. Peduncles solitary, 11–20 cm long. Bracts 3, verticillate, free to the base, elliptic, obscurely glandular-serrate at margins, acute at apices, 1–1.5 cm long, 0.5–0.9 cm wide, inserted 1–1.5 cm below flower base, deciduous. Flowers showy, 9–11 cm diam. Hypanthium campanulate, 1 cm long, 1.5 cm wide. Sepals thick, oblong-lanceolate, 4–5 cm long, 0.9–1.5 cm wide, wine-colored and glaucous on abaxial surface, bright purple on adaxial surface, carinate, with a prominent awn (0.4–)0.7–1 cm long. Petals oblong, rounded at apices, subequal to the sepals, bright purple. Coronal appendages violet, white at base, papillose, in 6–7 series, the 4–5 innermost filiform, 1–1.2 cm long, the 2 outermost thicker, 1.7–2 cm long. Operculum erect, 1.5 cm long, arising 0.5–0.7 cm from base of hypanthium, membranous to ca. ⅓ their length, slightly plicate. Nectar ring conspicuous, 0.3–0.4 cm below base of operculum, incurved and delimiting a nectar chamber. Limen surrounding the broadened base of gynophore, 0.3 cm above the floor of hypanthium. Trochlea absent. Gynophore 3–3.5 cm long, green, wine spotted. Filaments 0.8–1 cm long; anthers 0.8–1 cm long. Ovary ellipsoidal, 0.8–0.9 cm long, 0.4 cm wide, glaucous, glabrous. Fruits not seen.

Passiflora loefgrenii is restricted to the Ribeira River Basin, where it grows at edges of primary rainforest or along trails, climbing on shrubs or small trees.

Passiflora loefgrenii is referred to "series" *Lobatae* (sensu Killip) on account of the foliaceous verticillate bracts. Vegetatively, it closely resembles *P. amethystina* and *P. eichleriana*, other species of "series" *Lobatae* that occur at Intervales State Park. Although the three can be easily identified when flowers are present, sterile specimens are difficult to separate. *Passiflora loefgrenii* differs remarkably from these species by having long hanging peduncles and large purple flowers. *Passiflora amethystina* and *P. eichleriana* have, respectively, bluish purple and white flowers with much shorter erect peduncles. While *P. loefgrenii* has the series of coronal appendages of similar size densely disposed around the gynophore, the two other species have the outer series of appendages subequal to the petals and radially disposed over them, and the inner series is much shorter.

At Intervales State Park the flowering period of *Passiflora loefgrenii* extends from July to October. The time of flower opening and the behavior of the styles and anthers may vary according to temperature, and the flowers are visited both by hummingbirds and bees. *Passiflora loefgrenii* flowers open from 0900 to 1300h, and in the first hours of anthesis the stigmas and anthers are radially disposed, facing outward (cf. Janzen, 1968). During this phase, the hermit hummingbirds *Phaethornis eurynome* and *P. squalidus* frequently visit and pollinate the flowers, but bees do not contact the stigma and anthers. Later the style and anthers curve downward facing the corona. During this phase, carpenter bees (*Xylocopa* sp.) pollinate the flowers (L. C. Passos & F. A. Vitta, unpublished data). Thus, *Passiflora loefgrenii* benefits from both hummingbird and bee pollination.

Paratypes. BRAZIL. **São Paulo:** Entre Yporanga e Juru-Mirim, às margens do Rio Ribeira, 29.X.1894 (fl), *Loefgren & Edwall s.n.* (SP 10635); Eldorado, Parque Estadual de Jacupiranga, Núcleo Caverna do Diabo, Trilha entre a Cachoeira do Araçá e área conhecida como "descampado," 03. IX.1995 (fl), *V.C. Souza 9007* (ESA, SP).

Acknowledgments. I thank Fundação Florestal-SP for logistical support at Intervales State Park. Thanks are due to R. Mello-Silva for the Latin description and comments, and to J. R. Pirani for useful comments on the manuscript.

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Cycas lindstromii (Cycadaceae), a New Species from Southern Vietnam

Si-Lin Yang

Nong Nooch Tropical Garden, 163 Sukhumvit Highway, Sattahip, Chonburi 20250, Thailand; and Fairchild Tropical Garden, 11935 Old Cutler Road, Miami, Florida 33156, U.S.A.

Ken D. Hill

National Herbarium of New South Wales, Royal Botanical Gardens, Mrs Macquaries Road, Sydney 2000, Australia

Nguyen Tien Hiep

Institute of Ecology and Biological Resources, National Center for Sciences, Nghia Do, Du Liem, Hanoi, Vietnam

ABSTRACT. A new species, *Cycas lindstromii*, is described from Binh Thuan in southern Vietnam. It is allied to *C. siamensis*, but distinguished by its subterranean trunk, elongated megasporophyll, and shorter, keeled leaf. The new species is illustrated, and its distribution, ecology, and conservation status are discussed.

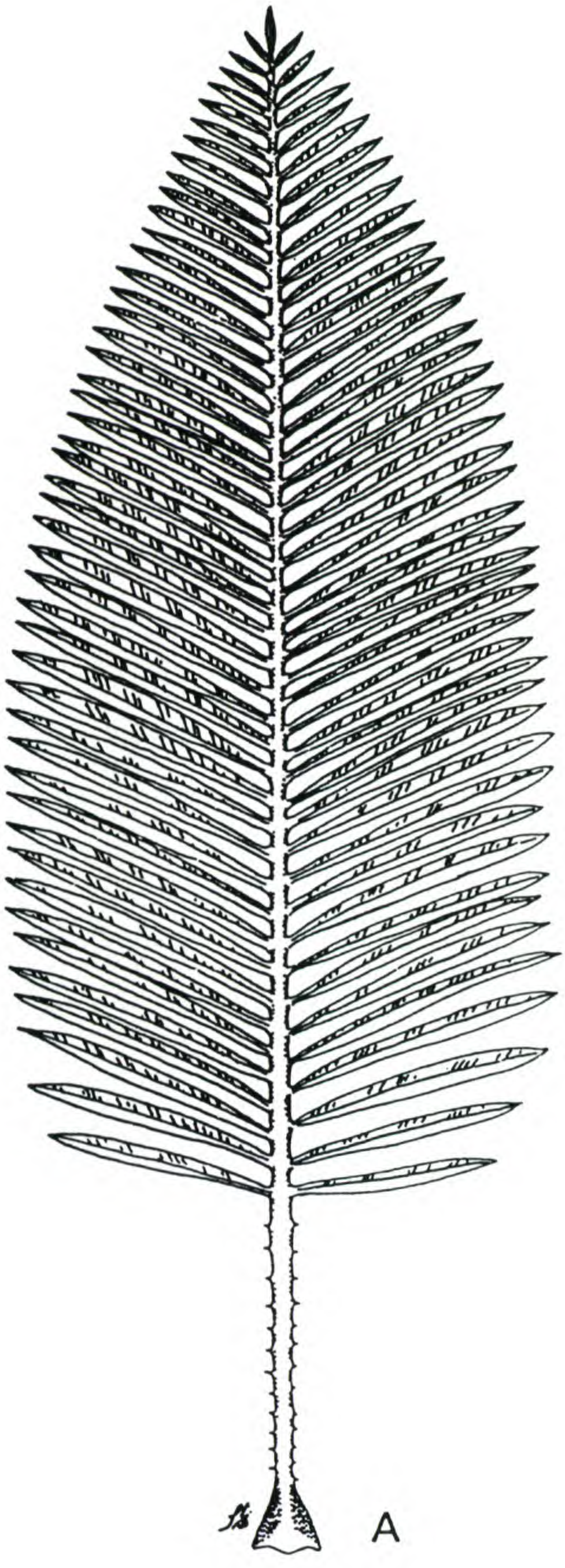
The senior author studied wild cycad populations in Vietnam during the periods 16 October to 2 December 1994 and 18 February to 1 March 1995 (Yang, 1996). One discovery was a distinct species occurring in arid coastal areas in southern Vietnam, where it is under threat of extinction from land clearing and collection for sale as a garden plant. Systematic studies by the authors have shown that this taxon is as yet undescribed. It is here described as a new species in order to draw attention to its conservation requirements, and to provide a valid name for regulatory usage.

Cycas lindstromii S.-L. Yang, K. D. Hill & N. T. Hiep, sp. nov. TYPE: Vietnam. Binh Thuan, Tuy Phong, Xa Chi Cong, near Doc Bao Da, 11°13′N, 108°38′E, alt. 25 m, 11 Nov. 1994, *S.-L. Yang 557* (holotype, FTG; isotypes, NSW, S). Figure 1.

Species similis *C. siamensis* Miquel, sed trunco subterraneo, foliis brevibus, megasporophylla lamina terminali elongata angusta differt.

Stem subterranean, often branched at apex, to 15–23 cm long, 13–25 cm diam., base swollen, surface white-gray, smooth. Leaves 2–12 , deep green adaxially, yellowish green abaxially, highly glossy, 50–78 cm long, strongly keeled (opposite pinnae inserted at 40–60° on rachis), with 18–60 pinnae. Petiole 6.0–15 cm long, glabrous, spinescent for 50–100% of length. Basal pinnae not gradually reducing to spines, occasionally forked. Median pinnae simple, glabrous, 100–130 × 7–10 mm, crowded and overlapping, 7–12 mm apart on rachis; section flat, margins flat, apices acute. Tomentum on cataphylls brown. Cataphylls narrowly triangular, soft, 20–50 × 3–7 mm at base. Microsporangiate cones fusiform, coriaceous, yellow, 16–20 cm long, 4–5 cm diam., peduncle length 3.0 cm. Microsporophyll lamina 10–16 × 11–15 mm, apical spine sharply upturned, 1–8 mm long. Megasporangiate cones 12 cm high, 7–9 cm diam.; megasporophylls 8–12 cm long, lamina ovate, 5.5–10 × 1.8–3.0 cm, deeply pectinate, with 6–13 pairs of soft lateral spines 8–12 × 4–5 mm; apical spine distinct from lateral spines, 30 × 4–5 mm at base. Ovules 2, glabrous. Seeds ovoid, 31–35 × 20–30 mm; sarcotesta reddish orange, not pruinose, 3–7 mm thick; fibrous layer present; spongy layer absent.

Cycas lindstromii is nearest to *C. siamensis* (Miquel, 1863) but differs in its subterranean and frequently branched trunk, its shorter, keeled leaves with basal pinnae not progressively reducing to spines, its more slender male cone, and its relatively narrower and more elongated megasporophyll lamina. The two are placed in *Cycas* sect. *Indosinenses*. This section is defined by the pectinate megasporophyll lamina, the coriaceous male cone, and the glabrous ovules. Within the section, these two species make up subsection *Indosinenses*, defined by the small, narrow male cones and the short



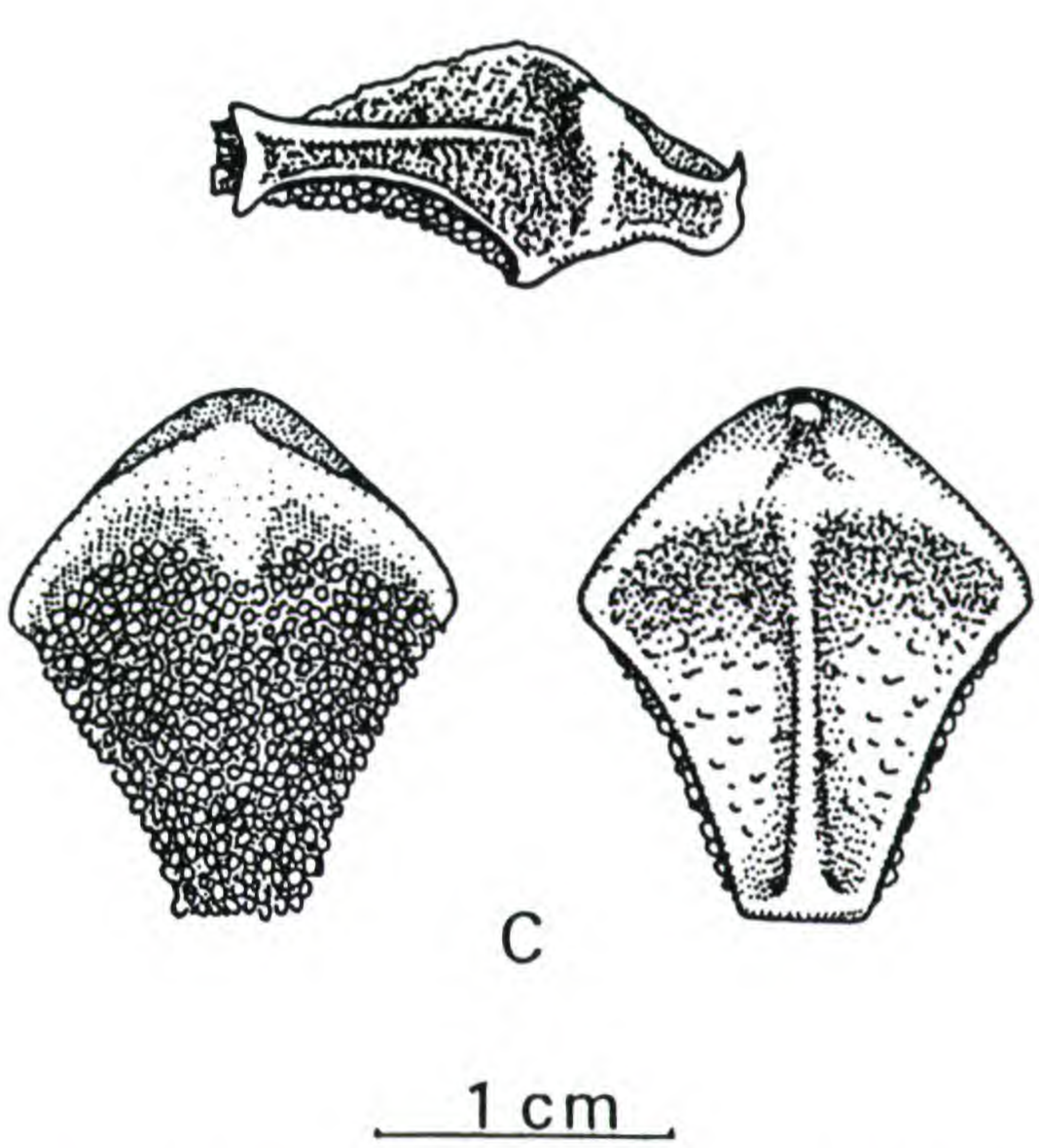


Figure 1. *Cycas lindstromii* S.-L. Yang, K. D. Hill & N. T. Hiep. —A. Leaf. —B. Megasporophyll with two mature seeds. —C. Microsporophylls.

stature of leaves and trunks. Their close relationship was confirmed by genetic data (Yang & Meerow, 1996).

The new species occurs in sandy grassland and dry open forest at low elevations and near the ocean along the east coast of southern Vietnam (Fig. 2). Locals in this area have been extensively collecting wild plants for sale as garden and landscape sub-

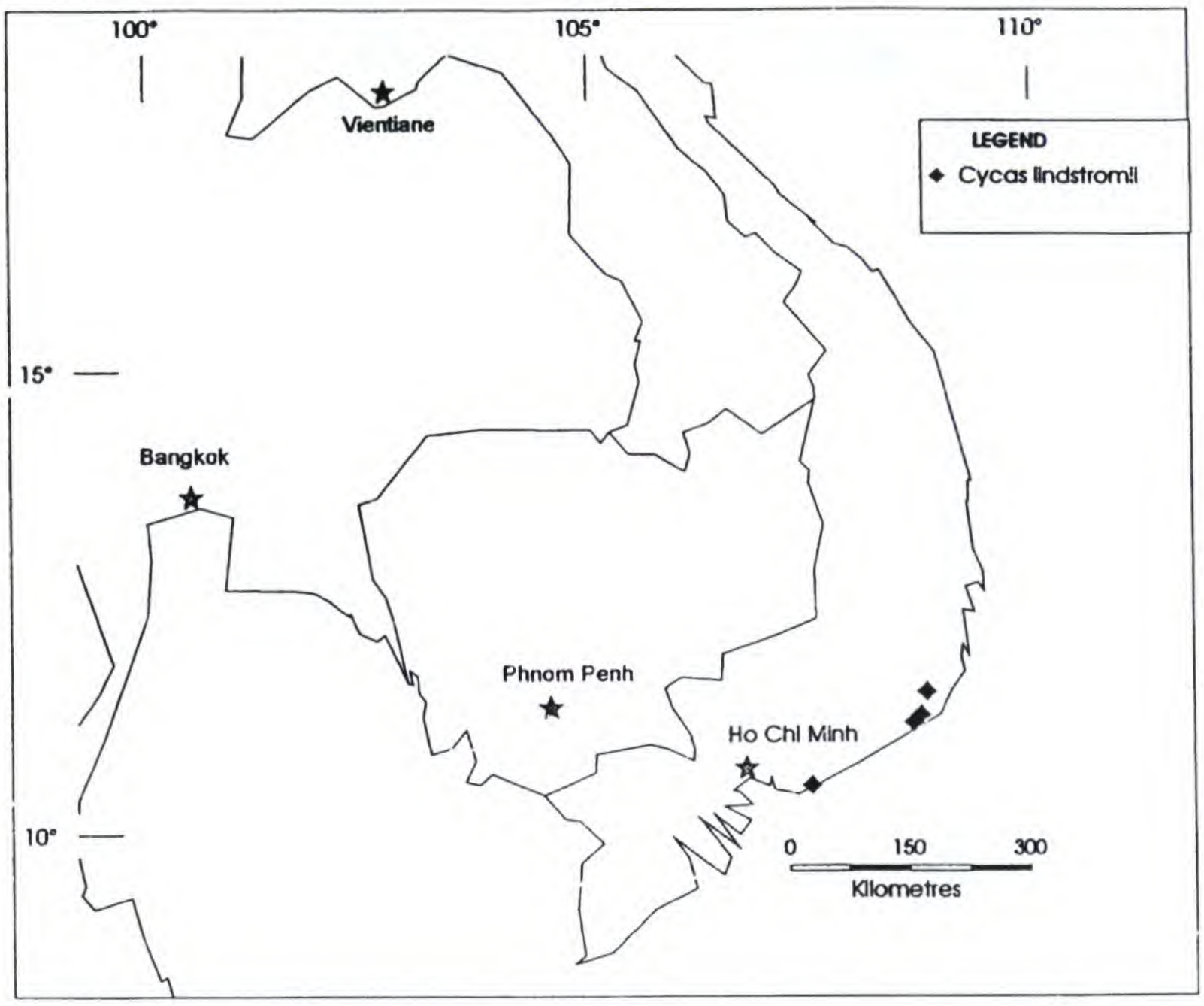


Figure 2. Distribution of *Cycas lindstromii*.

jects. This species is consequently regarded as under threat of extinction should this practice continue.

The epithet honors Anders Lindström, a cycad enthusiast from Stockholm, Sweden, who assisted in the initial discovery of this species, and who has devoted valuable time and energy toward conservation of Asian cycads.

Paratypes. VIETNAM. Near Vinh Hoa town, Binh Thuan Province, 11°18′N, 108°43′E, altitude 30 m, 23 Feb. 1995, *Yang 733* (FTG); N of Ca Na Town, Thuan Hai Province, 11°33′N, 108°47′E, 21 Feb. 1995, *Yang 729* (FTG); near Xuyen Moc Town, Ba Ria Province, 10°32′N, 107°28′E, altitude sea level, 20 Nov. 1994, *Yang 563* (FTG). Cultivated at Nong Nooch Tropical Garden, Sattahip, Chonburi, Thailand, originally collected from southern Vietnam, 13 Apr. 1994, *Hill 4613* (NSW).

Acknowledgments. The field research was funded by the Montgomery Foundation, Miami, Florida, U.S.A., and Nong Nooch Tropical Garden, Chonburi, Thailand. Anders Lindstrom assisted in the field study. N. K. Ban and V. N. Long guided in the field collecting. Stig Dalström prepared the illustration of this species. We thank Phan Ke Loc, Dennis Stevenson, and Piet Vorster for comments on the manuscript.

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A New Species of *Platymiscium* Vogel (Papilionoideae: Dalbergieae) from Costa Rica

Nelson Zamora
Instituto Nacional de Biodiversidad, (INBio), 22-3100, Santo Domingo, Heredia, Costa Rica

Bente Bang Klitgaard
Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AE, United Kingdom

ABSTRACT. *Platymiscium curuense* N. Zamora & Klitgaard (Papilionoideae: Dalbergieae), a new species from Costa Rica, is described and illustrated, and its taxonomic affinities are discussed.

Platymiscium Vogel, a neotropical genus of ca. 18 species (Klitgaard, 1996), is represented in Costa Rica by 5 species including the one described herein. While preparing an account of legumes for the *Costa Rican Manual Project* (first author) and a revision of *Platymiscium* (second author), a new species was discovered from the Pacific lowlands of Costa Rica. The new species belongs to a group with small flowers and pubescent inflorescence rachises, including *P. albertinae* Standley & L. O. Williams, *P. parviflorum* Bentham, and *P. hebestachyum* Bentham.

Platymiscium curuense N. Zamora & Klitgaard, sp. nov. TYPE: Costa Rica. Puntarenas: Refugio Nacional de Vida Silvestre Curú, Paquera, Península de Nicoya, 2 Mar. 1985 (fl), *Gómez et al. 23357* (holotype, INB; isotypes, AAU, BM, COL, CR, F, K, MEX, MO, NY, PMA, QCNE, US). Figure 1.

Arbor 15–30 m; ramuli teres, glabri. Folia 5-foliolata, elliptica vel angusto-elliptica et ovato-elliptica, apice acuminata, basi obtusa, glabra vel nitida utrinque, lamina (5–)6.2–17 cm longa, (2.2–)3.5–6.8 cm lata. Inflorescentia racemosa, 1.7–8.5 cm longa, rhachidibus dense tomentoso-pubescentibus, bracteis et bracteolis brevis, pilosis. Flores sessiles vel subsessiles, 7–9 mm longi; calyx 2–4 mm longus, campanulatus, glaber; petala aurea, vexillis 7–7.5 mm longis, 5–6 mm latis, orbiculatis. Stamina 10, monadelpha. Legumen planum, oblongum vel ellipticum, 9.7–13.5 cm longum, 3.3–3.8 cm latum, glabrum.

Tree 15–30 m tall; straight bole, smooth bark, internodes of juvenile branchlets hollow or solid, glabrous; stipules deciduous, not seen. Leaves opposite, 5-foliolate; leaf axis 5–11 cm long, rachis as long as or longer than petiole; leaflets elliptic, narrow-elliptic or ovate-elliptic, (5–)6.2–17 cm long, (2.2–)3.5–6.8 cm wide, apex acuminate, rounded or obtuse at the base, blade membranaceous, glabrous, and reticulate; petiolules 5 mm long. Inflorescence of short, erect, axillary, simple racemes, with up to 10 inflorescences per leaf axis; inflorescence axis thinly furrowed, often with persistent ledgelike pedicel scars (most easily visible on dried material), with matted whitish indumentum, axis 1.7–8.5 cm long, including a peduncle (0.5–)1.5–2 cm long, racemes up to 40-flowered. Flowers (5–)7–9 mm long, pedicels to 2 mm long, slender, hairy, persistent, without food bodies basally; bracts spathulate, 1 × 0.5 mm, caducous before anthesis, hairy; calyx campanulate, 2–4 mm long, articulated from pedicel, base acuminate, robust, glabrate, brown, 5-toothed, two vexillary teeth connate to ⅔ their length, the other three similar to each other with obtuse apices, pubescent along margins of the teeth; corolla yellow, standard orbicular, heart-shaped, 7–7.5 mm long, 5–6 mm wide, clawed, wing petals 8–8.5 mm long, 3 mm wide, short-clawed, with sculpture pattern basally along upper margin; keel petals 7–7.5 × 3 mm, long-clawed, adnate along ca. ½ of lower margins, free part of margins sparsely ciliate; androecium monadelphous, 9 stamens fused progressively higher abaxially, the vexillary stamen only fused basally; anthers dimorphic; ovary long-stipitate, ciliate along margins of suture. Fruit a samara, elliptic to oblong, 9.7–13.5 × 3.3–3.8 cm, acuminate at both ends, glabrous, exocarp rusty brown at maturity; stipe 10–11 mm long.

This new species is related to *Platymiscium albertinae*, *P. parviflorum*, and *P. hebestachyum* because of its small flowers and tomentose inflorescence rachis. From *P. albertinae* it can be distinguished by its glabrous (rather than hairy) leaflets, up to 10 inflorescences per leaf axil (rather than solitary), and elliptic to oblong (rather than short elliptic) samara; from *P. parviflorum* it is distinguished by its 5-foliolate mostly elliptic (rather than 3-foliolate mostly ovate) leaves and elliptic to

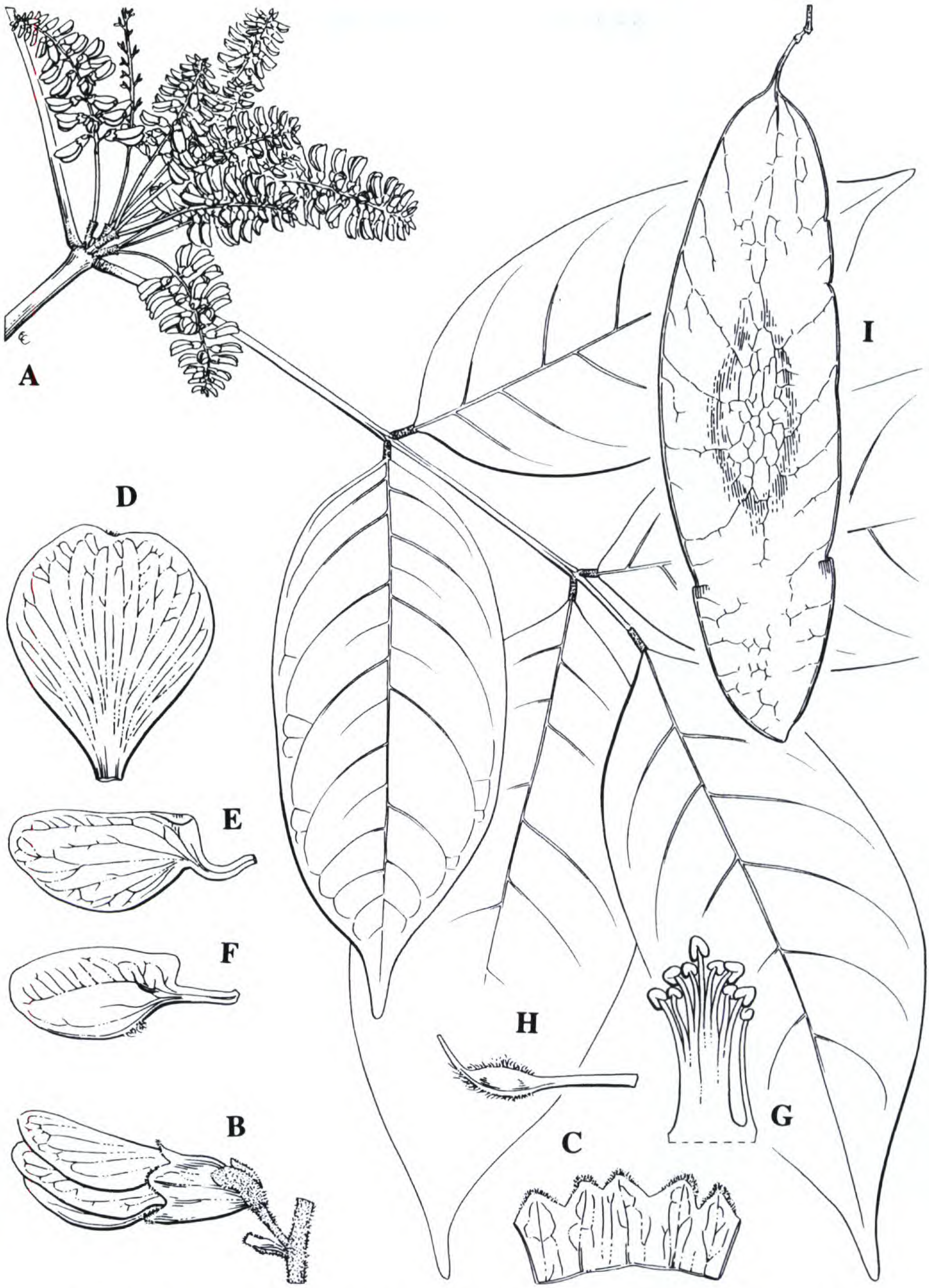

Figure 1. *Platymiscium curuense* N. Zamora & Klitgaard. —A. Flowering branch, ×2/3. —B. Flowers with bracteoles, pedicel, and portion of rachis, ×4. —C. Calyx opened out, ×5. —D. Standard, ×5. —E. Wing petal, ×5. —F. Keel petal, ×5. —G. Androecium, ×5. —H. Gynoecium, ×5. —I. Samara, ×2/3. Flowering material from *Gómez et al. 23357*. Fruiting material from *Jiménez 365*.

oblong (rather than short elliptic) samara; and from *P. hebestachyum* by its 5-foliolate (rather than 3-foliolate) leaves that are membranaceous with a greenish color upon drying (rather than coriaceous with a yellowish color).

As far as we know, the new species is endemic to the Pacific coast of Costa Rica, from the Refugio Nacional de Vida Silvestre Curú, Nicoya Peninsula down to Parque Nacional Corcovado, Osa Peninsula, from near sea level (10) to 400 m. The localities where the species has been collected have similar climate and vegetation type. Flowers have been collected in February, March, and August, fruits in April, March, June, and August.

Paratypes. COSTA RICA. **Puntarenas:** Refugio Nacional de Vida Silvestre Curú, Paquera, Península de Nicoya, 26 Aug. 1986 (fr), *Jiménez 365* (CR); Reserva Biológica Carara, Estación Quebrada Bonita, 9°46′N, 84°36′W, 30 m, 26 jun. 1990 (fr), *Bello & Rojas 2293* (CR, INB, K, MO); Cantón de Osa, Reserva Forestal Golfo Dulce, 8°42′N, 83°31′W, 50 m, 18 ago. 1992 (fr), *Aguilar 1264* (CR, INB, K, MEXU, MO, NY); Cantón de Golfito, Parque Nacional Corcovado, Estación El Tigre, río Tigre, 8°31′30″N, 83°25′40″W, 200–300 m, 27 Feb. 1994 (fl), *Aguilar et al. 3148* (BM, COL, CR, F, INB, K, MEXU, MO, NY, PNA, QCNE, US); Parque Nacional Corcovado, Sirena, Ollas Trail, 8°28′N, 83°35′W, 1–20 m, 21 mar. 1989 (fl), *Kernan & Phillips 983* (CR, K, MO); río Calro de Golfito, 7 km SE de río Calro, cerca del río Sorpresa, 150 m, 12 mar. 1987 (fr), *Jiménez 465* (CR). **San José:** Zona Protectora La Cangreja, Santa Rosa de Puriscal, márgenes del río Negro, 9°42′24″N, 84°23′35″W, 400 m, 10 ago. 1992 (fl), *Morales 315* (CR, INB); Turrubares, Reserva Biológica Carara, puesto Carara orillas del río del Sur, 500 m N de la cuesta El Chuzazo a partir de la desembocadura de la Quebrada Chimarruda, 9°45′55″N, 84°31′45″W, 200 m, 19 abr. 1995 (fr), *Zamora 2252* (BM, COL, CR, F, INB, K, MEXU, MO, NY, PNA, US); Carara National Park, mature moist forest río Carara near Carara Guard Post, 9°46′N, 84°32′W, 130 m, 5 Apr. 1993 (st), *Gentry et al. 79418* (INB, MO).

Acknowledgments. We thank Eleanor Cathrine for the line drawings and Barry Hammel and Michael Grayum for comments on an earlier draft of this paper.

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The Generic Disposition of *Quidproquo confusum* and *Sinapis aucheri* (Brassicaceae)

Ihsan A. Al-Shehbaz
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

Suzanne I. Warwick
Eastern Cereal and Oilseed Research Centre, Agriculture Canada, Research Branch, Central Experimental Farm, Ottawa, Ontario K1A 0C6, Canada

ABSTRACT. The generic name *Quidproquo* is reduced to synonymy of *Raphanus*. The new combination *R. confusus* is proposed. Evidence for the retention of *Brassica aucheri* in *Brassica*, rather than in *Sinapis*, is presented.

The identity of two Middle Eastern species of mustards has been confused, resulting in a nomenclatural instability that has continued from the mid 1800s to the present. The confusion is attributed to the fact that the two species were historically treated as one, their typification was mishandled, and their generic disposition was not resolved.

Boissier (1842) described *Brassica aucheri* Boissier from a single collection (*Aucher 203*) from northern Iraq. Boissier (1849) transferred the species to *Raphanus* (as *R. aucheri* (Boissier) Boissier) and cited two collections, one from Galilee (northern Israel) and another from Persia (Iran). However, he overlooked the fact that the specimens from Israel, and those he (Boissier, 1867) later cited from southern Lebanon, represent a species entirely different from that of Iraq and Iran. Schulz (1919) was the first to recognize that there were two species involved. However, he retained the name *R. aucheri* for the eastern Mediterranean (Israel, Lebanon, Syria) species, excluded the type (*Aucher 203*) of that name by stating (p. 209) "excl. pl. Auch. et Kotsch.," and recognized the plant of Iraq and Iran as *Sinapis aucheri* (Boissier) O. E. Schulz. As indicated by Baillargeon (1985, 1986), Schulz contradicted Article 48.1 of the International Code of Botanical Nomenclature and thus created a later homonym, *R. aucheri* O. E. Schulz not Boissier, for the eastern Mediterranean species.

The eastern Mediterranean plant needed a new name, and Greuter and Burdet (1983) named it *Quidproquo confusum*, whereas Al-Shehbaz (1985) named it *Raphanus boissieri*. Greuter and Burdet were correct in providing a legitimate name for the species, but they failed to typify it, and they placed it in the monotypic genus *Quidproquo* without discussing anything about the affinities and the reasons for separating this new genus from the related *Brassica*, *Raphanus*, and *Sinapis*. On the other hand, Al-Shehbaz placed the species in the correct genus, *Raphanus*, but overlooked the fact that Greuter and Burdet provided a substitute name for *R. aucheri* O. E. Schulz. Therefore, the name *Raphanus boissieri* Al-Shehbaz is illegitimate, and the correct name for the eastern Mediterranean plant should be *R. confusus*, the combination of which is herein proposed.

Raphanus confusus (Greuter & Burdet) Al-Shehbaz & Warwick, comb. nov. Basionym: *Quidproquo confusum* Greuter & Burdet, Willdenowia 13: 94. 1983. *Raphanus aucheri* O. E. Schulz, Pflanzenr. IV. 105(Heft 70): 209. 1919, not *R. aucheri* (Boissier) Boissier, Diagn. Pl. Orient. Nov. I. 2(8): 45. 1849. TYPE: Israel [as Palestine]. Galilaea borealis, near Hunin and not far from Safed, 900 m, 22 Apr. 1897, *Bornmüller 114* (lectotype, designated by Baillargeon (1985), W).

Raphanus boissieri Al-Shehbaz, J. Arnold Arbor. 66: 275. 1985. TYPE: Palestine [Israel]. Galilee, April–May 1846, *E. Boissier s.n.* (holotype, GH; isotype, G-Bois).

Although Baillargeon (1985, 1986) provided a detailed nomenclatural history of this complex, he refrained from evaluating the generic disposition of the two species involved. He distinguished *Quidproquo* from *Raphanus* on the basis of the complete absence of the valvular fruit segment, which is present in *Raphanus* as a rudimentary and seedless structure. However, we consider this difference as minor, not justifying the recognition of *Quidproquo* as distinct from *Raphanus.* It is interesting to note that the lectotype sheet of *Q. confusum* was initially annotated by Baillargeon as *R. schulzii* Baillargeon, a name that was never published.

The Iraqi–Iranian species was treated by Hedge (1968) and Hedge and Lamond (1980) as *Sinapis aucheri,* just as was done by Schulz (1919). Molecular studies on this species (Warwick & Black, 1991) show that it is most closely related to *Brassica deflexa* Boissier, a Middle Eastern species with the same chromosome number of $2n = 14$. Warwick and Black's study also shows that both species fall in a clade ("*Brassica*" lineage) quite distinct from the clade that includes the remaining species of *Sinapis.* Their data are consistent with the recognition of the species as a morphologically anomalous element in *Sinapis.* The presence of a long, corky, torulose, 6–10-seeded terminal fruit segment is anomalous in *Sinapis* but not so in *Brassica.* Therefore, Boissier's (1842) original description of the Iraqi–Iranian species as *Brassica aucheri* reflects the most accurate generic disposition.

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Two New Species of *Hybanthus* (Violaceae) from Central America and a Regional Key for the Genus

Harvey E. Ballard, Jr. and Mark Allen Wetter*

Herbarium, University of Wisconsin-Madison, Birge Hall, 430 Lincoln Drive, Madison, Wisconsin 53706-1381, U.S.A. *Present address: Department of Environmental and Plant Biology, Porter Hall, Ohio University, Athens, Ohio 45701, U.S.A.

Nelson Zamora

Herbario, Instituto Nacional de Biodiversidad, Apartado Postal 22-3100, Santo Domingo de Heredia, Costa Rica

ABSTRACT. Two morphologically and ecologically distinctive, woody *Hybanthus* species from Central America are described, illustrated, and mapped. *Hybanthus denticulatus* inhabits lowland rainforest from northern Nicaragua to eastern Panama and is allied to Mexican and Guatemalan *H. elatus*. *Hybanthus hespericlivus* is restricted to mid-elevation forest on the western mountain slopes of northern Costa Rica and resembles Panamanian *H. jefensis* and northern Mesoamerican *H. sylvicola*. A key to Central American species of *Hybanthus* is provided.

Systematic and nomenclatural studies of Mexican and Central American Violaceae for several flora projects, including the "Manual de Plantas de Costa Rica" and "Flora Mesoamericana," have resulted in the discovery of two new species of *Hybanthus* commonly misidentified as *H. guanacastensis* Standley, a species of higher-elevation forest in northern and eastern Costa Rica. Both new species resemble *H. guanacastensis* and other members of *Hybanthus* subg. *Hybanthus* in their woody habit and axillary short shoots with one or more peduncles. However, their strongly zygomorphic flowers, with the bottom petal at least twice as long as the lateral and upper ones and strongly differentiated into a slender claw and greatly expanded blade, and free filaments of the stamens, suggest instead an alliance to subgenus *Ionidium* (Ventenat) Schulze-Menz. The infrageneric relationships of the new species are as yet unresolved.

Morton was the last to revise the genus *Hybanthus* in Mexico and Central America, through synoptical and piecemeal efforts (Morton, 1944, 1971). While he initially provided a pared-down key for herbaceous and semi-herbaceous species that he recognized in 1944, he left out woody shrubs and treelets in this earlier key and never published a more inclusive key in subsequent works in which he recognized additional species of *Hybanthus*. Exacerbating the situation are several names used in publications by Morton and his contemporaries that the first author has determined are synonyms. Since Morton's time, no single key or taxonomic resource has been available for *Hybanthus* species of Mexico and Central America. Consequently, approximately 25% of *Hybanthus* specimens from this region are misidentified. A treatment of *Hybanthus* for the entire region will be published in "Flora Mesoamericana" several years in the future. In the interim the following key will facilitate identification of dried flowering Central American specimens of *Hybanthus*. Synonyms in brackets represent names recognized as distinct species by Morton (1944, 1971).

KEY TO THE SPECIES OF *HYBANTHUS* IN CENTRAL AMERICA

1a. Stems predominantly or entirely herbaceous; plant 0.1–0.5 m tall.
  2a. Corollas 20–35 mm long; sepal margins dentate; plant densely and coarsely long-hirsute throughout . . . . . *H. calceolaria* (L.) Schulze-Menz
  2b. Corollas 9–17 mm long; sepal margins entire; plant glabrous or pubescent but not densely and coarsely long-hirsute throughout.
    3a. Leaf blades 3.2–8.0 times as long as broad; at least the lowest leaf nodes opposite (lower leaves deciduous on *H. attenuatus*).
      4a. Upper leaves alternate; leaf blades broadly lanceolate, widest at middle, tapering gradually to a cuneate or slightly convex base . . . *H. attenuatus* (Humboldt & Bonpland) Schulze-Menz

4b. All leaves opposite; leaf blades narrowly linear-acuminate, widest near the abruptly truncate base . . . . . *H. oppositifolius* (L.) Taubert

3b. Leaf blades up to 2.5 times as long as broad; all leaf nodes alternate.

5a. Leaf blades elliptic, widest at the middle, 2.0–2.5 times as long as wide; stem pubescence incurved and ascending . . . . *H. thiemei* (F. Donnell Smith) C. V. Morton [*H. longipes* Dowell]

5b. Leaf blades broadly obovate, widest above the middle, up to 1.5 times as long as wide; pubescence straight and spreading . . . . . *H. verbenaceus* (HBK) Loesener

1b. Stems completely woody; plant 0.5–6.0 m tall.

6a. Corollas 3–9 mm long, weakly zygomorphic, the bottom petal 1.1–1.3 times as long as lateral ones, not strongly differentiated into a slender claw and greatly expanded blade.

7a. Flowers many in pedunculate cymes; stems often thorny . . . . . *H. yucatanensis* Millspaugh

7b. Flowers solitary or in few-flowered glomerules; stems unarmed.

8a. Leaf blades lance-ovate to ovate-elliptic, sharply acute at apex, margins irregularly and coarsely (sometimes doubly) serrate . . . . . *H. guanacastensis* Standley

8b. Leaf blades oblanceolate to narrowly obovate, obtuse to rounded at apex, margins crenate to subentire . . . . . *H. mexicanus* Gingins [*H. costaricensis* Melchior]

6b. Corollas 7–45 mm long, strongly zygomorphic, the bottom petal 1.5–2.0 times as long as lateral petals, differentiated into a slender claw and a greatly expanded blade.

9a. Petioles 10–30 mm long; leaf blades widest near the symmetrically broadly rounded base . . . . . *H. galeottii* (Turczaninow) C. V. Morton

9b. Petioles 1–5 mm long; leaf blades widest near the middle, cuneate or asymmetrically subtruncate to narrowly rounded at the base.

10a. Flowers 35–45 mm long; leaf blades coarsely and irregularly serrate . . . . . *H. prunifolius* (Humboldt & Bonpland) Schulze-Menz

10b. Flowers 7–18 mm long.

11a. Leaf blade margins uniformly serrulate, crenulate or denticulate with 35 or more teeth on each side; stipules 3–12 mm long.

12a. Leaf margins denticulate; young leaves membranous and translucent; northern Nicaragua to eastern Panama . . . . . *H. denticulatus* H. E. Ballard, M. A. Wetter & N. Zamora, sp. nov.

12b. Leaf margins crenulate; young leaves thick; Mexico and northern Guatemala . . . *H. elatus* (Turczaninow) C. V. Morton [*H. brevis* (Dowell) Standley, *H. chiapasiensis* Lundell]

11b. Leaf blade margins subentire to remotely low-serrate or crenate with up to 20 teeth on each side; stipules to 2 mm long.

13a. Leaf blades with (5–)6–8 major lateral veins on each side, sharply acuminate at tip; stipules pale; southern Mexico to Belize and northern Honduras . . . . *H. sylvicola* Standley & Steyermark

13b. Leaf blades with 3–4(–5) major lateral veins on each side, rounded at very tip; stipules brown or tinged with red-brown; Costa Rica and Panama.

14a. Leaves green on both sides; corollas (9–)11–13 mm long; northwestern Costa Rica . . . *H. hespericlivus* H. E. Ballard, M. A. Wetter & N. Zamora, sp. nov.

14b. Undersides of leaves with fine red-brown punctae and reticulations; corollas 7–10 mm long; central Panama . . . . . *H. jefensis* Todzia

Hybanthus denticulatus H. E. Ballard, M. A. Wetter & N. Zamora, sp. nov. TYPE: Costa Rica. Osa: Uvita de Osa, Distrito Bahía Ballena, bosque atrás de casa de León González, cerca a la Quebrada Curingo, 9°09′5″N, 83°43′35″W, 20 Dec. 1992, *N. Zamora 1912, B. Hammel, R. Aquilar & A. Fernández* (holotype, WIS; isotypes, CR, INB, MO, US). Figure 1A–D.

Habitus suffruticosus petalum infimum unguiculatum petalis summis et lateralibus suo duplo longius vel paulo longius folia acuminata dentibus numerosis, characteribus *H. elatus* (Turczaninow) C. V. Morton simile sed foliis latioribus denticulatis basi obtusa ad truncatam junioribus membranaceis ab ea recedens.

Spreading few-stemmed shrub or treelet arising from a rhizome, to 6 m tall and 10 cm diam. at the base, stems entirely woody, sparsely to moderately branched, branches villosulous near the tips. Leaves alternate, young blades at the tips of branches membranous and translucent, glabrate or glabrous, the fully expanded ones thin but opaque, glabrous, at maturity 4.5–16.3 mm long and 1.7–6.5 mm broad, oblanceolate to obovate-lanceolate, acuminate at the tip, often asymmetrical and typically narrowly obtuse to truncate at the base, major primary veins 6–8, margins typically uniformly denticulate (infrequently serrulate) with sharply acuminate teeth; petioles 2–5 mm long, glabrous to sparsely villous; stipules 3–12 mm long, free, tan to ivory, lance-acuminate, thickly keeled, the keel exserted as an apical awn, minutely erose along the

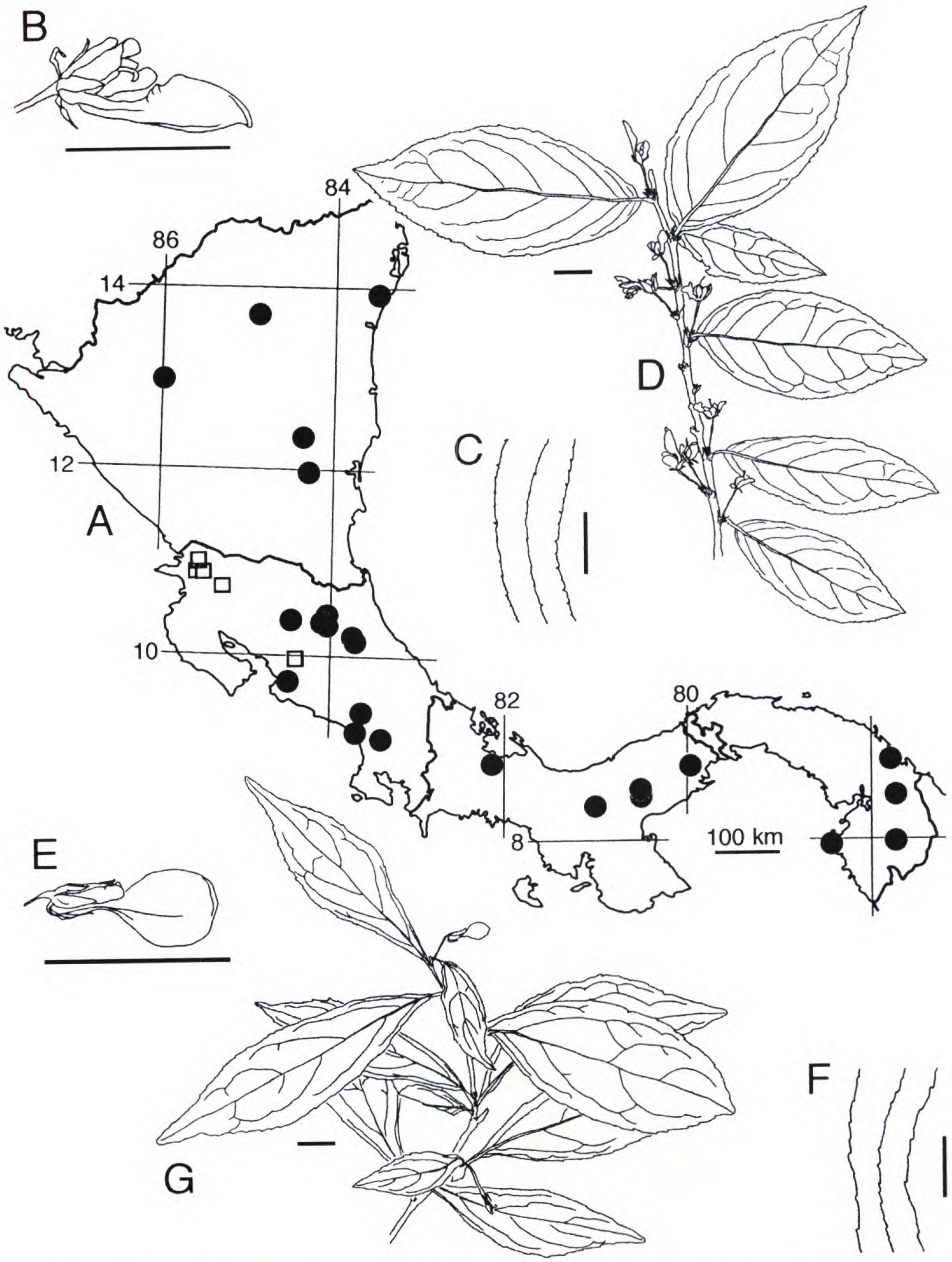

Figure 1. —A. Ranges of *Hybanthus denticulatus* and *Hybanthus hespericlivus*; closed circles = *H. denticulatus*, open squares = *H. hespericlivus*. B–D. *Hybanthus denticulatus* H. E. Ballard, M. A. Wetter & N. Zamora. —B. Flower. —C. Leaf margins. —D. Habit. Drawn from holotype. E–G. *Hybanthus hespericlivus* H. E. Ballard, M. A. Wetter & N. Zamora. —E. Flower. —F. Leaf margins. —G. Habit. Drawn from holotype. Scale bars = 1 cm. Each symbol may represent two or more proximal collections on the range map.

narrow to broad membranous margins. Inflorescence of 1–2 flowers from axillary short shoots 2–5 mm long; bracts of short shoots similar to stipules but smaller, 1–3 mm long; peduncles 7–21 mm long, jointed above the middle, glabrate to moderately villosulous, bearing a pair of bracteoles ca. 1 mm long near the base; flower 10–16 mm long, strongly zygomorphic; calyx glabrous, sepals 5, 2–5 mm long, narrowly ovate-triangular to lance-acuminate, herbaceous with semi-membranous margins, the lateral pair of sepals slightly larger than the others; corolla white overall, the blade of the bottom petal with a purple blotch near the base just above the juncture with the claw, the claw yellowish within; petals 5, upper ones oblong-lanceolate and rounded at the tip, 4–6 mm long, lateral ones oblong-lanceolate to obpyriform and rounded to truncate at the tip, 5–7 mm long, bottom one 10–16 mm long, at least twice as long as lateral and upper petals, slightly protuberant basally where it surrounds the glandular bottom stamens, narrowed in the basal half as a slender, longitudinally furrowed claw and expanded abruptly and broadly in the apical half to a deltoid-obovate blade 5–9 mm broad, broadly cuneate at the base, mucronate at the tip, the claw sparsely villous inside and glabrous to minutely puberulent near the base outside; style not exserted at anthesis, 3–4 mm long, slender-cylindrical, gradually and uniformly expanding distally, abruptly bent to a short-conic tip; stamens 3–5 mm long, the filament two-thirds as long and one-fourth as broad as the anther proper, the ventral thecae together narrower than the anther body, tipped by an ovate-oblong, orange-brown connective appendage as long as or up to one-third longer than the anther body; the two lowest stamens 20% larger than the other three, on broader filaments bearing a dorsal gland, the dorsum of the anther villous with a tuft of white hairs on each side at the base; capsule narrowly ovoid, 7–12 mm long, glabrous, distinctly veined, green when young but drying tan after dehiscence; seeds 2–3 per valve, 3–4 mm long, obovoid to suborbicular, moderately lustrous, medium to dark brown, lacking an elaiosome.

Habitat and phenology. The denticulate leaf margin, unique among North and Central American *Hybanthus*, provides the specific epithet. This new species is widely distributed in wet lowland forest from sea level mostly to 500 m, rarely up to 1000 m, from northern Nicaragua to the Colombia–Panama border. It flowers primarily from December through May, occasionally as early as October.

Considering its distinctive morphology, wide range, the large number of verified herbarium collections, and much previous work on the genus in Mexico and Central America, both monographic (Dowell, 1906; Lundell, 1968; Morton, 1944, 1971; Schulze-Menz, 1936) and floristic (Robyns, 1967; Standley, 1937), it is remarkable that *H. denticulatus* has been passed over until now. It is similar to *H. guanacastensis* in its woody habit, axillary short shoots bearing flowers and ivory to tan stipules, and has routinely been misidentified as such. Both new species differ strikingly from *H. guanacastensis* in their strongly zygomorphic flowers with very large and well-differentiated bottom petals. The leaves of *H. denticulatus* diverge from those of *H. guanacastensis* in a number of details including distinctly thinner blades (the younger ones especially being membranous and translucent), the uniformly denticulate rather than coarsely and irregularly serrate margins, and the tendency toward more asymmetrically rounded blade bases.

Following the misidentifications of others, Todzia (1989) mistook the present species for *H. guanacastensis* in her comparison of *H. jefensis* and the key to Panama *Hybanthus* species. However, examination of Standley's holotype of *H. guanacastensis*, deposited at US, clearly refers the latter name to the Costa Rican species with small, weakly zygomorphic flowers and irregularly serrate leaves.

The present new species is isolated altitudinally and ecologically from *H. guanacastensis* and *H. hespericlivus* in Costa Rica, growing in wetter tropical forest sites and in most instances at much lower elevations. While it also grows at very low elevations in Panama, *H. denticulatus* ascends to somewhat higher altitudes in the low mountain ranges of northern and western Nicaragua where the other two species are absent. It attains greater stature than either species and approaches the habit of a treelet, often reaching 5–6 m tall and a substantial DBH. It is most similar to *H. elatus*, a woody few-stemmed shrub or treelet of mid-elevation forests from central Mexico to northern Guatemala, but differs from the latter in certain vegetative features indicated in the key as well as a more southern range and a predominantly lowland wet forest habitat.

Paratypes. COSTA RICA. **Alajuela:** Finca Los Ensayos, *Alverson 1996* (CR, MO). **Heredia:** Zona Protectora La Selva, *Schatz & Bockbrader 1039* (CR, DUKE); Zona Protectora La Selva, *Schatz & Fetcher 1057* (CR, F); Zona Protectora, northern slopes Volcán Barba, *Grayum 3118 & Schatz* (DUKE). **Limón:** cerca al Río Toro Amarillo, *Jiménez M. 2814* (CR, F, MO); Bordes Del Río Toro Amarillo, *Jiménez M. 2787* (CR, F); near the Río Toro Amarillo, *Godfrey 66297* (MO); Toro Amarillo, *Lent 314* (F, US). **Puntarenas:** Uvita de Osa, *Zamora 1496, Jiménez, González & Gamboa* (CR, K); Orilla de quebrada la Mona,

Soto KR-663 (CR). **San José:** basin of El General, *Skutch 4936* (CR, F); Reserva Biológica Carara, *Zamora 2094 & II Curso de Botánica* (INB, WIS). NICARAGUA. **Matagalpa:** Salto Santa Emilia, *Sandino 2763* (MO). **Zelaya:** E de Caño Angostura, *Sandino 4633* (DUKE); Caño Hormiguerro SE of Cerro la Pimienta number 1, *Pipoly 5053* (DUKE); Caño Zamora on Río Rama, *Stevens 8832* (DUKE); region of Braggman's Bluff, *Englesing 234* (F). PANAMA. **Bocas del Toro:** 8.5 road-miles from bridge near Fortuna Dam on road towards Chiriquí Grande, *McPherson 6749* (CAS, DUKE, US). **Coclé:** New Works at Aseradera Rivera, *Folsom & Robinson 2378* (MO); area around Rivera Sawmill, *Folsom & Page 5971* (MO); El Copé, *Hammel 2377* (MO, US); Atlantic slope of the Continental Divide near sawmill (whiskey) above El Copé, *Knapp & Dressler 3451, 3434* (MO); El Copé, ½ hour walk from sawmill, *Antonio 2083* (MO); near saw-mill, 8 km N of El Copé (28 km NW of Penonome), *Maas, Berg & Dressler 2737* (MO). **Darién:** S of Garachiné near Pacific coast above Casa Vieja, *Hensold 1076* (F); Río Pirre, 10 mi. S of El Real near "Dos Bocas," *Foster 2265 & Lowenbach* (MO, US); Camp Tiotuma, *Duke 15509* (MO); 0.5 to 1.5 mi. E of Manene, *Hartman 12100* (MO); Río Tuquesa, at middle Tuquesa Mining Company camp called Charco Peje, *Mori 7037* (MO); Río Tuquesa, at lower Tuquesa Mining Company camp called Charco Chiva, *Mori 6941* (MO). **Panamá:** Cerro Campana, *McPherson 7906* (WIS). **San Blas:** Hydro Camp Cuadi on Río Cuadi, *Duke 15459* (F, MO). **Veraguas:** NW of Santa Fe, *Mori & Kallunki 5233* (MO).

Hybanthus hespericlivus H. E. Ballard, M. A. Wetter & N. Zamora, sp. nov. TYPE: Costa Rica. Guanacaste: Parque Rincón de La Vieja Liberia, del Puesto Santa María siguiendo el sendero del mirador, subiendo por la fila al noroeste, 10°46′N, 85°18′W, 28 Feb. 1988, *G. Herrera 1561* (holotype, WIS; isotypes, INB, MO). Figure 1A, E–G.

Habitus suffruticosus petalum infimum unguiculatum petalis summis et lateralibus suo duplo longius folia oblanceolata remoti-serrata stipulis minutis brunneis, characteribus *H. jefensis* Todzia et *H. sylvicola* Standley et Steyermark affinis, differt a *H. jefensis* foliis multo grandioribus acuminatis maculis rubris carentibus, differt a *H. sylvicola* apicibus foliorum rotundatis venis paucioribus floribus et capsulis grandioribus.

Spreading few-stemmed shrub arising from a rhizome, usually to 1.5 m (rarely to 2 m) tall and 1 cm diam. at the base, stems entirely woody, sparsely to moderately branched, branches finely puberulent near the tips. Leaves alternate, youngest blades at the tips of branches thin and semi-translucent, glabrous, the fully expanded ones opaque, at maturity 3.5–10.3 mm long and 1.3–3.6 mm broad, oblanceolate, abruptly short-acuminate at the tip, long-tapering to the narrowly cuneate base, major primary veins 3–4(–5), margins in the basal third essentially entire and in the apical two-thirds remotely low-serrate with narrowly rounded teeth; petioles 2–6 mm long, glabrous to sparsely puberulent; stipules 0.7–1 mm long, free, tinged with red-brown, lance-triangular, with a slender keel and broad semi-membranous ciliolate margins. Inflorescence of 1–2 flowers from axils on young branches or from axillary short shoots up to 2 mm long on older ones; bracts of short shoots similar to stipules in size and shape; peduncles 11–17 mm long, jointed above the middle, finely puberulent, bearing a pair of bracteoles up to 1 mm long below the middle; flower (9–)11–13 mm long, strongly zygomorphic; calyx glabrous to sparsely puberulent, sepals 5, 2.5–3 mm long, lanceolate to ovate-lanceolate and acuminate to a sharp tip, herbaceous with narrow semi-membranous eciliate or ciliolate margins, the lateral pair of sepals slightly larger than the others; corolla white; petals 5, upper ones oblong-lanceolate and narrowly rounded to acutish at the tip, 3–4 mm long, lateral ones oblong-lanceolate to obspatulate and narrowly rounded at the tip, 4.0–4.5 mm long, bottom one (9–)11–13 mm long, at least twice as long as lateral and upper petals, slightly protuberant basally where it surrounds the glandular bottom stamens, narrowed in the basal half as a slender, longitudinally furrowed claw and expanded abruptly and broadly in the apical half to an ovate-triangular blade 5–7 mm broad, broadly acute to mucronate at the tip, broadly cuneate to subcordate at the base, the claw and base of the blade villous inside and puberulent outside; style not exserted at anthesis, 3–3.5 mm long, slender-cylindrical, gradually and uniformly expanding distally, abruptly bent to a short-conic tip; stamens 3–3.5 mm long, the filament up to one-fourth as long and one-third as broad as the anther proper, the ventral thecae together narrower than the anther body, tipped by an ovate-oblong, orange-brown connective appendage as long as or up to one-third longer than the anther body; the two bottom stamens 20% larger than the other three, on broader filaments bearing a dorsal gland, the dorsum of the anther glabrous or the bottom ones villosulous with a tuft of short white hairs on each side at the base; capsule narrowly ovoid, 8–9 mm long, glabrous, weakly veined, green when young but drying tan after dehiscence; seeds 2–3 per valve, ca. 3 mm long, obovoid to suborbicular, moderately lustrous, medium brown, lacking an elaiosome.

Habitat and phenology. While *Hybanthus hespericlivus* is distinct morphologically, geographically, and ecologically from other members of the genus in Mexico and Central America, plants are rather nondescript and do not lend themselves well to innovative descriptive names. The specific epithet "hespericlivus," or "western slope," was con-

cocted to characterize the peculiar mid-elevation distribution of the species along the northward extension of the cordillera in northwestern Costa Rica. This new species is restricted to mid-elevation mesic primary forest on the western slope of the cordillera in northern Costa Rica. Most collections have been taken from the general area of Volcán Rincón de la Vieja, especially in the valley between that peak and Volcán Miravalles. The species grows mostly between 1000 and 1100 m elevation but has been collected once at 800 m. Flowering from February to July, occasionally as early as November.

This species has a small primary geographic range in northwestern Costa Rica, excepting the single disjunct population east of the tip of the Nicoya Peninsula. Further collecting on mid-elevation west-facing slopes between the two portions of its bimodal range may reveal additional populations.

It is morphologically close to *Hybanthus sylvicola* of southern Mexico, Belize, Guatemala, and northern Honduras and somewhat less so to *H. jefensis* (the holotype of which was examined at MO), a narrow endemic of Cerro Jefe in central Panama. It differs from those species primarily in foliar and stipular characters as indicated in the key. Like *H. jefensis* in particular, *H. hespericlivus* remains relatively short, all collections being from plants 0.6–2 m tall. It grows at higher elevations than the others and inhabits primary montane forest rather than lower-elevation rainforest or premontane forest characteristic of *H. jefensis* and *H. sylvicola*. Although it has commonly been misidentified as *H. guanacastensis*, it resembles that species even less than *H. denticulatus*. Like *H. denticulatus*, it is immediately distinguished from that species by its larger and strongly zygomorphic flowers. Its foliage is also very different from that of *H. guanacastensis*. The two species are largely allopatric in distribution and elevation, the latter ranging almost entirely to the southeast and mostly at higher altitudes. A single collection from the Parque Nacional Rincón de la Vieja at 900–1200 m elevation (*Davidse et al. 23430*, MO) represents a putative hybrid of *H. guanacastensis* and *H. hespericlivus* with leaves and flowers intermediate in morphology and generally larger than those of either species.

Paratypes. COSTA RICA. **Alajuela:** 27.6 km NE of Liberia in forested pass area between Volcán Santa Maria and Volcán Miravalles, *Utley 5909* (DUKE, MO). **Guanacaste:** Parque Nacional Guanacaste, Estación Cacao, *Acevedo 29 & el curso II de Parataxónomos* (CR); Parque Nacional Guanacaste Estación Cacao, *Bello 2246* (INB); Parque Rincón de la Vieja, del puesto Santa María siguiendo el sendero del mirador, *Herrera 1561* (INB, WIS); Parque Nacional Guanacaste, Estación Mengo, *III INB 46* (CR); lower forested slopes of Volcán Orosí at the Hacienda Los Inocentes about 15 km SE of La Cruz, *Wilbur & Stone 10203* (DUKE). **San José:** In monte Aguacate, *Ørsted 647* (F).

Acknowledgments. We thank the directors and curators of CHAPA, CIIDIR-Durango, CR, DUKE, ENCB, F, GH, IBUG, IEB, LL, MEXU, MICH, MO, NY, POM, RSA, TEX, US, XAL, and ZEA for providing loans of Violaceae specimens, and the curatorial staff of CR, INB, K, MICH, MO, US, and WIS for assistance and work space. Travel was supported by a grant from the University of Wisconsin Natural History Museums Council to the first author and a grant from the University of Wisconsin-Madison Herbarium E. K. & O. N. Allen Fund to the second author. We thank Marshall Crosby, Barry Hammel, and Carol Todzia for helpful comments on the manuscript and Kandis Elliot of the UW-Madison Botany Department for guidance with the computer-generated figure.

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A New Subspecies and New Combinations in Chinese Triticeae (Poaceae)

Shou-Liang Chen

Institute of Botany, Jiangsu Province and Academia Sinica, Nanjing, Jiangsu 210014, People's Republic of China

ABSTRACT. *Triticum aestivum* subsp. *yunnanense* King ex S. L. Chen from Qinghai Province, China, is described as new. In addition, a new combination in *Psathyrostachys*, 18 new combinations in *Elymus*, and 2 new combinations in *Kengyilia* are proposed.

During preparation of the Poaceae (Gramineae) treatment for the *Flora of China*, it became evident that the nomenclature of several specific and infraspecific taxa in Triticeae needed adjustment. I propose the following novelties in order to make these names available for this and other Chinese floristic works now in progress.

ELYMUS

Elymus aliena (Keng) S. L. Chen, comb. nov. Basionym: *Roegneria aliena* Keng, in Keng & S. L. Chen, J. Nanjing Univ. (Biol.) 1: 31. 1963. TYPE: China. Hubei: Lai-Yuan Hsien, near Tsun-Er-Kou, 1100 m, 14 June 1934, *K. M. Liou 2424* (holotype, PE).

Roegneria foliosa Keng, in Keng & S. L. Chen, J. Nanjing Univ. (Biol.) 1: 32. 1963. Syn. nov. TYPE: China. Nei Mongol: Peiling Miao, Madoni Ama, 10 Aug. 1935, *Roerich Exped. 770* (holotype, PE).

Roegneria foliosa is here reduced to synonymy of *Elymus aliena*: the two are very similar in having culms loosely tufted, leaf sheaths longer than internodes, leaf blades flat and 4–9 mm wide, spikelets with 4–6 florets, glumes oblong-lanceolate and 7–8 mm, lemmas lanceolate, and first lemma 9–10 mm and with awns 1–2.5 cm.

Here and elsewhere in this paper, the names cited as "Keng, in Keng & S. L. Chen, J. Nanjing Univ. (Biol.) vol. 1, 1963" represent validation of nomina nuda given by Keng in "Clav. Gen. & Sp. Gram. Sin.," which first appeared in 1957.

Elymus aristiglumis (Keng & S. L. Chen) S. L. Chen var. **hirsutus** (H. L. Yang) S. L. Chen, comb. nov. Basionym: *Roegneria aristiglumis* Keng & S. L. Chen var. *hirsuta* H. L. Yang, Acta Phytotax. Sin. 18: 253. 1980. TYPE: China. Xizang: Gaize, 4450 m, 6 Sep. 1974, *Xizang Exped. Inst. Biol. Qinghai 4294* (holotype, HNWP).

Variety *hirsutus* has involute leaf blades less than 2 mm wide and lemmas with hirtellous calluses. Variety *aristiglumis* has flat leaf blades 4–5 mm wide and lemmas with glabrous calluses.

Elymus aristiglumis (Keng & S. L. Chen) S. L. Chen var. **leianthus** (H. L. Yang) S. L. Chen, comb. nov. Basionym: *Roegneria aristiglumis* Keng & S. L. Chen var. *leiantha* H. L. Yang, Acta Phytotax. Sin. 18: 253. 1980. TYPE: China. Xizang: Ali, Pulan, 5200 m, 20 July 1976, *Qinghai-Xizang Exped. 76-8250* (holotype, HNWP).

Variety *leianthus* has glumes and lemmas glabrous and smooth throughout and lemmas with awns up to 4 cm. Variety *aristiglumis* has glumes with scabrous veins and lemmas hirsute on the upper part, with awns 2–3 cm.

Elymus barbicallus (Ohwi) S. L. Chen var. **pubifolius** (Keng) S. L. Chen, comb. nov. Basionym: *Roegneria barbicalla* Ohwi var. *pubifolia* Keng, in Keng & S. L. Chen, J. Nanjing Univ. (Biol.) 1: 25. 1963. TYPE: China. Shanxi: Lin-Shih Hsien, Mien Shan, 1350 m, 29 May 1929, *T. Tang 887* (holotype, PE).

Variety *pubifolius* has leaf blades adaxially pilose, whereas variety *barbicallus* has leaf blades glabrous or scabrous on both surfaces.

Elymus barbicallus (Ohwi) S. L. Chen var. **pubinodis** (Keng) S. L. Chen, comb. nov. Basionym: *Roegneria barbicalla* Ohwi var. *pubinodis* Keng, in Keng & S. L. Chen, J. Nanjing Univ. (Biol.) 1: 24. 1963. TYPE: China. Hubei: Nei-Kiu Hsien, 17 June 1951, *H. Y. Liou 441* (holotype, PE).

This taxon differs from the other two varieties of

Elymus barbicallus by its culms with puberulent internodes just below the nodes and its white puberulent nodes.

Elymus ciliaris (Trinius) Tzvelev var. **amurensis** (Drobov) S. L. Chen, comb. nov. Basionym: *Agropyron amurense* Drobov, Trudy Bot. Muz. Imp. Akad. Nauk 12: 50. 1914. TYPE: Russia. Amur: Soyuznoe village downstream of Amur, 19 June 1891, *S. Korzhinski* (holotype, ?; isotype, LE).

Variety *amurensis* is readily distinguished from variety *ciliaris* by its oblong-lanceolate glumes with acute to acuminate apexes and longer lemmas.

Elymus ciliaris (Trinius) Tzvelev var. **hirtiflorus** (C. P. Wang & H. L. Yang) S. L. Chen, comb. nov. Basionym: *Roegneria hirtiflora* C. P. Wang & H. L. Yang, Bull. Bot. Res., Harbin 4(4): 86. 1984. TYPE: China. Nei Mongol: Datsingshan-Bakouchi, 15 July 1960, *C. P. Wang 099* (holotype, NMAC).

Variety *hirtiflorus* differs from variety *ciliaris* in having pubescent leaf blades, oblong-lanceolate glumes with white hairs along veins and margins, hispid lemmas with pointed scabrous backs, and awns 1.5–2.5 cm. Variety *ciliaris* has elliptic-lanceolate glumes, lemmas 8–9 mm and hispid only on back, and awns 1–3 cm with long-ciliate margins.

Elymus ciliaris (Trinius) Tzvelev var. **japonensis** (Honda) S. L. Chen, comb. nov. Basionym: *Agropyron japonense* Honda, Bot. Mag. (Tokyo) 49: 698. 1935. New name for *A. japonicum* Honda, Bot. Mag. (Tokyo) 41: 384. 1927, not *A. japonicum* Tracy, U.S.D.A. Farmers Bull. 18: 13. 1894. TYPE: Japan. Hondo: Kasukabe, prov. Musashi, 1926, *K. Hisauchi* (lectotype, here designated, TI).

Variety *japonensis* differs from variety *ciliaris* by its glumes 6–8 mm, lemmas ca. 8 mm, awns 0.5–2.5 cm, and paleas scabrous along upper keels. Variety *ciliaris* has glumes 7–9 mm, lemmas 8–9 mm, awns 1–3 cm, and paleas ciliate along upper keels.

Elymus ciliaris (Trinius) Tzvelev var. **submuticus** (Honda) S. L. Chen, comb. nov. Basionym: *Agropyron ciliare* (Trinius) Franchet var. *submuticum* Honda, J. Fac. Univ. Tokyo, Sect. 3, Bot. 3: 27. 1930. TYPE: Japan. Kiusiu: in littore Kushikino, prov. Satsuma, 1925, *Y. Doi 84* (holotype, TI).

This variety differs from variety *ciliaris* by its lemmas with pointed apexes or with awns less than 7 mm. Variety *ciliaris* has hispid lemmas with reflexed awns 10–30 mm.

Elymus confusus (Roshevitz) Tzvelev var. **breviaristatus** (Keng) S. L. Chen, comb. nov. Basionym: *Roegneria confusa* (Roshevitz) Nevski var. *breviaristata* Keng, in Keng & S. L. Chen, J. Nanjing Univ. (Biol.) 1: 52. 1963. TYPE: China. Xinjiang: Yen-Che, Tsa-Ta-Shih-Ha, 19 Aug. 1954, *M. S. Chu 2* (holotype, N).

Variety *breviaristatus* differs from variety *confusus* in having culms ca. 30 cm tall and 5-veined lemmas with awns 1.3–1.5 cm. Variety *confusus* has culms 50–100 cm tall and 5–7-veined lemmas with awns 2–2.5 cm.

Elymus dahuricus Turczaninow var. **xiningensis** (L. B. Cai) S. L. Chen, comb. nov. Basionym: *Elymus xiningensis* L. B. Cai, Acta Bot. Boreal.-Occid. Sin. 13(1): 71. 1993. TYPE: China. Qinghai: Xining, Nanshan, 2600 m, 5 Aug. 1985, *Yuhu Wu 1857* (holotype, HNWP).

This variety differs from variety *dahuricus* by its lemmas ca. 8 mm with straight awns 2–5 mm. Variety *dahuricus* has lemmas ca. 9 mm with awns 10–20 mm.

Elymus formosanus (Honda) A. Löve var. **pubigerus** (Keng) S. L. Chen, comb. nov. Basionym: *Roegneria formosana* (Honda) Ohwi var. *pubigera* Keng, in Keng & S. L. Chen, J. Nanjing Univ. (Biol.) 1: 60. 1963. TYPE: China. Taiwan: no locality or collector given, "Fan Mem. Inst. Biol. No. 82369" (holotype, PE).

Variety *pubigerus* differs from variety *formosanus* in having culms 30–50 cm tall, leaf sheaths pubescent at base, blades 2–4 mm wide, and lemmas with awns 1–2 cm. Variety *formosanus* has culms 60–90 cm tall, glabrous leaf sheaths, blades 4–6 mm wide, and lemmas with awns 2–3.5 cm.

Elymus jufinshanicus (C. P. Wang & H. L. Yang) S. L. Chen, comb. nov. Basionym: *Roegneria alashanica* Keng var. *jufinshanica* C. P. Wang & H. L. Yang, Bull. Bot. Res., Harbin 4(4): 87. 1984. TYPE: China. Nei Mongol: Daqingshan-Jufinshan, 2200 m, 15 July 1964, *Y. C. Ma & C. R. Wu 20* (holotype, NMAC).

Elymus jufinshanicus differs from *E. alashanicus* (Keng) S. L. Chen in having glumes equal or subequal to the first lemma and densely pubescent on

the inner surface, lemmas with awns ca. 5 mm, and densely pubescent rachilla. *Elymus alashanicus* has glumes much shorter than the first lemma and glabrous on both surfaces, lemmas without awns, and glabrous rachilla.

Elymus leianthus (Keng) S. L. Chen, comb. nov. Basionym: *Roegneria leiantha* Keng, in Keng & S. L. Chen, J. Nanjing Univ. (Biol.) 1: 42. 1963. TYPE: China. Qinghai: Ta-Tung Hsien, 2380 m, 3 July 1945, *Hoogin 758* (holotype, N).

Elymus leianthus is similar to *E. fibrosus* (Schrenk) Tzvelev in having 2-sided spikes, subequal glumes, and paleas equal or subequal to lemmas. It differs from *E. fibrosus* by its leaf blades 2–4 mm wide, spikes ca. 12 cm, and lemmas with awns 4–5 mm. *Elymus fibrosus* has leaf blades 3–7 mm wide, spikes 6–10 cm, and lemmas with subulate-acuminate apexes.

Elymus mutabilis (Drobov) Tzvelev var. **praecaespitosus** (Nevski) S. L. Chen, comb. nov. Basionym: *Agropyron praecaespitosum* Nevski, Izv. Glavn. Bot. Sada SSSR 29: 541. 1930. TYPE: [Kyrgyzstan]. Turkestania. Kuldsha, Jultu-Aristan, 7 July 1879, *A. Regel 108* (holotype, LE).

This variety differs from variety *mutabilis* by its spikelets usually glaucous or purplish glaucous.

Elymus sinicus (Keng) S. L. Chen, comb. nov. Basionym: *Roegneria sinica* Keng, in Keng & S. L. Chen, J. Nanjing Univ. (Biol.) 1: 33. 1963. TYPE: China. Qinghai: Hsi-ning Hsien, near Hsü-Chia-Chai, 19 Aug. 1944, *Y. L. Keng & P. C. Keng 5505* (holotype, N).

The length of the awn and width of the leaf blades are very variable in this species. Therefore, it is not practical to divide it into varieties.

Elymus tenuispicus (J. L. Yang & Y. H. Zhou) S. L. Chen, comb. nov. Basionym: *Roegneria tenuispica* J. L. Yang & Y. H. Zhou, Novon 4: 307. 1994. TYPE: China. Xizang (Tibet): Eluo, Changdu to Ruiwuqi highway 22 km, alt. 3580 m, 25 Sep. 1989, *J. L. Yang & B. R. Lu 890955* (holotype, SAUT).

Elymus tenuispicus is similar to *E. pendulinus* by its nodding spike and lemmas with straight awns. It differs from *E. pendulinus* in having shorter spikes 9.2–10.5 cm, glumes 5–6.5 mm, and lemmas 6.5–8 mm. *Elymus pendulinus* has spikes 14–20 cm, glumes 7–10 mm, and lemmas 9–11 mm.

Elymus tridentatus (Yen & J. L. Yang) S. L. Chen, comb. nov. Basionym: *Roegneria tridentata* Yen & J. L. Yang, Novon 4: 310. 1994. TYPE: China. Qinghai: Wenquan, Xinhai, km 337 on highway 214, rocky slope, 3750 m, 19 Sep. 1992, *J. L. Yang et al. 9202014* (holotype, SAUT; isotype, MO).

Elymus tridentatus is similar to *E. tsuhushiensis* by its $2n = 6x = 42$ and genome SYH; hence it should be referred to *Elymus*. It differs from *E. tsuhushiensis* by its lemmas, which are oblong-lanceolate, white pubescent on lateral and lower parts, and truncate and 3-toothed at apex. *Elymus tsuhushiensis* has lemmas only hispid along margins and with awns 18–40 mm.

KENGYILIA

Kengyilia melanthera (Keng) J. L. Yang, Yen & Baum var. **tahopaica** (Keng) S. L. Chen, comb. nov. Basionym: *Roegneria melanthera* (Keng) Keng var. *tahopaica* Keng, in Keng & S. L. Chen, J. Nanjing Univ. (Biol.) 1: 78–79. 1963. TYPE: China. Qinghai: Tahopai, 19 July 1935, *C. W. Yao 873* (holotype, PE).

Variety *tahopaica* differs from variety *melanthera* in having culms 40–60 cm, densely pubescent glumes, and awnless or pointed lemmas. Variety *melanthera* has culms 15–25 cm, glabrous or puberulent glumes, and lemmas with awns 2–4 mm.

Kengyilia thoroldiana (Oliver) J. L. Yang, Yen & Baum var. **laxiuscula** (Melderis) S. L. Chen, comb. nov. Basionym: *Agropyron thoroldianum* Oliver var. *laxiusculum* Melderis, in Bor, Grasses of Burma, Ceylon, India & Pakistan 696. 1960. TYPE: China. S. Tibet: Khamba Jong, 8 and 11 July 1903, *F. E. Younghusband 32* (holotype, K).

Variety *laxiuscula* has glumes only scabrous on midveins and rather loose spikes 5–7.5 cm (excluding awns). Variety *thoroldiana* has villose glumes and denser spikes 3–4 mm.

PSATHYROSTACHYS

Psathyrostachys juncea (Fischer) Nevski var. **hyalantha** (Rupr.) S. L. Chen, comb. nov. Basionym: *Elymus hyalanthus* Rupr., in Osten-Sacken & Rupr., Sert. Tianschan. [Mém. Acad. Imp. Sci. Saint Pétersbourg, ser. 7, 14:] 36.

1869. TYPE: [Kyrgyzstan]. Dschaman-Davan, 20 July 1867, *Osten-Sacken* (holotype, LE).

Psathyrostachys juncea var. *hyalantha* is easily distinguished from variety *juncea* by its culms with short soft hairs below the spike and its purple anthers. Variety *juncea* has glabrous and nearly smooth culms and yellow anthers.

TRITICUM

Triticum aestivum L. subsp. **yunnanense** King ex S. L. Chen, subsp. nov. *Triticum aestivum* subsp. *yunnanense* King (Sp. Coll. Res. Nanjing Agr. Coll. 2: 21–22. 1959), nom. invalid. TYPE: China. Qinghai: Xining, cultivated in NW Pl. Inst. Biol. Acad. Sin., 2230 m, 14 Aug. 1990, *L. B. Cai 54* (holotype, HNWP).

A typo internodis rhacheos flagilibus; glumis ovatis durioribus, glabris vel puberulis; fructis rubris, fulvidis vel albellis praesertim recedit.

The name was invalidly published because the description was not accompanied by a Latin diagnosis, and no type was designated.

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A New Combination in *Eriochrysis* (Poaceae: Andropogoneae)

Tarciso S. Filgueiras
Reserva Ecológica do IBGE, Caixa Postal 08770, Brasília, DF 70312-970, Brazil

ABSTRACT. The new combination *Eriochrysis filiformis* (Hackel) Filgueiras is made based on *Saccharum filiforme* Hackel. A full description of the species is given based on recent collections.

Leptosaccharum was originally described as a monotypic subgenus of *Saccharum* L. by Hackel (1889) based on a collection of *Balansa* (no. 231) taken at Caaguazu, Paraguay. This subgenus later became the basis for the establishment of the genus *Leptosaccharum* by Camus (1923), with a single species, *L. filiforme* (Hackel) Camus. While proposing his new genus, Camus (1923) made a mistake in citing the basionym, i.e., he cited "*Andropogon filiforme* Hack." This "error" was later corrected (Camus, 1956), i.e., *Saccharum filiforme* Hackel. The genus remained little known for several decades. This was perhaps principally due to the fact that its only species is rarely collected and therefore poorly represented in herbarium collections.

It is intriguing to realize that most authors who dealt with this genus failed to see its relationship with the Andropogoneae (Camus, 1923, 1956; Smith & Wasshausen, 1977, 1981; Nicora & Rúgolo, 1987); instead they placed it in the Paniceae. Watson and Dallwitz (1992) are an exception for they placed the genus in the Andropogoneae. It was only in 1986 that Clayton and Renvoize reduced *Leptosaccharum* to a synonym of *Eriochrysis* Beauv., although without offering any evidence to support their decision.

Careful examination of recent collections of this species proved that indeed it belongs in *Eriochrysis*. The plants are perennials, with pilose nodes, the inflorescence is a reduced panicle, covered with rufous hairs, the rachis is fragile, the pedicels display unequal length, and the spikelets are paired, one bisexual and the other feminine. Both spikelets are similar in size and shape, although the feminine is slightly smaller. The lower glume is chartaceous, fringed with rufous hairs at the margins. These are all diagnostic features of *Eriochrysis*. In Watson and Dallwitz (1992) *Leptosaccharum* is considered both as distinct (p. 377) and as a synonym of *Eriochrysis* (p. 513). These authors presented a detailed anatomical description of the genus but misinterpreted its spikelet organization when they described the spikelets as solitary and only hermaphroditic and the lower glume as missing. None of the material examined by me (an isotype, plus nine collections from Brazil) presented any of these gross morphological features. Based on all the available evidence, the formal transfer of *Leptosaccharum filiforme* to *Eriochrysis* is made herein.

Eriochrysis filiformis (Hackel) Filgueiras, comb. nov. Basionym: *Saccharum filiforme* Hackel, in A. L. P. P. de Candolle & A. C. P. de Candolle, Monogr. phan. 6: 127. 1889. TYPE. Paraguay. "Caaguaza" [Caaguazu]: "in pratis uliginosis," s.a., *Balansa 231* (holotype, P not seen; isotype, US).

Since no recent description of this species is available anywhere, it seems appropriate to provide a detailed description here.

Densely caespitose perennials; rhizomes short, knotty. Culms 2–4-noded, erect, unbranched in their vegetative portions, 30–55 cm long; internodes hollow, glabrous, stramineous to purplish; nodes densely pilose. Leaves mostly basal; sheaths rounded at the back, strongly striate, glabrous, both margins glabrous; auricles absent; ligule membranous, hyaline, 1–1.5 mm long, pilose at the apex; hairs at the apex of the ligule pale, 2–3 mm long; blades flat to inrolled upon drying, linear to setaceous, 10–45 cm long and 1–3 mm wide, smooth and glabrous on the abaxial side, glabrescent and rough on the adaxial side, apex acute to subpungent. Inflorescence a contracted, terminal, rufous panicle, 4–7 cm long and 0.5–0.8 cm wide; inflorescence rachis easily breaking at maturity, pilose, the hairs rufous. Pedicels of unequal length, short and long, the short 2–3 mm long, the long one 4–6 m long. Spikelets paired, similar, elliptical; the short-pedicelled spikelet 4.5–5.5 mm long, bisexual, with a ring of rufous hairs at the base, the hairs 2–4 mm long; lower glume 4–4.8 mm long, chartaceous, glabrescent to pilose, 5–7-nerved, the nerves prominent; upper glume similar to the lower one, 3.5–4 mm long, chartaceous, glabrescent to pilose, 5–7-nerved, the nerves prominent; lemma hyaline, 3–3.3 mm long, shortly pilose, margins cil-

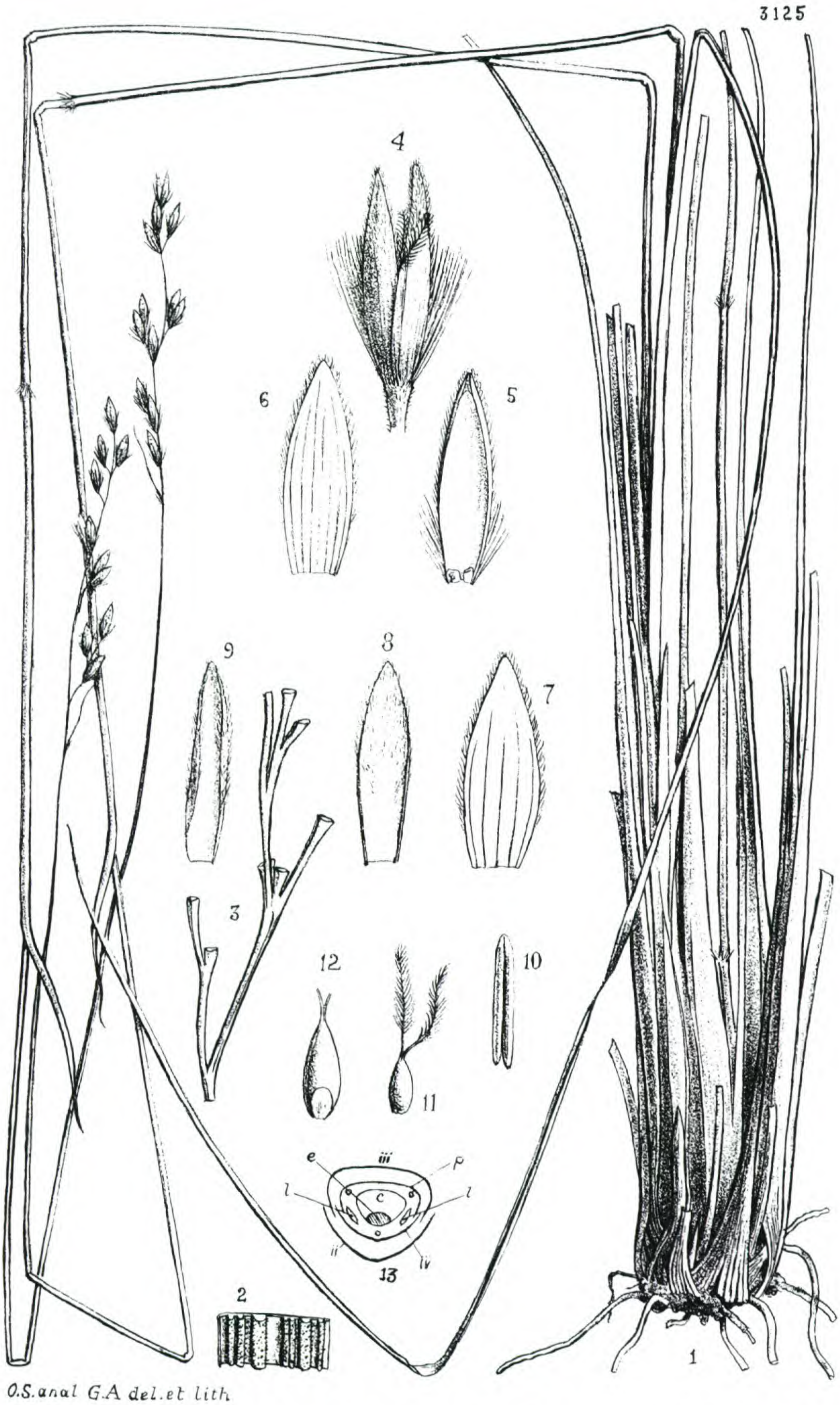

Figure 1. *Eriochrysis filiformis* (Hackel) Filgueiras, from Stapf, 1927: tab. 3125. —1. Habit. —2. Part of leaf blade, adaxial side, ×10. —3. Part of an inflorescence, showing the naked pedicels (the spikelets have been removed and the indumentum omitted), ×3. —4. Spikelet, frontal view. —5. Upper glume, lemma and lodicules. —6. Lower glume. —7. Upper glume. —8. Lemma. —9. Palea. —10. Anther. —11. Gynoecium. —12. Caryopsis. —13. Diagram of a spikelet: ii: Lower glume; iii: upper glume; iv: lemma; p- palea; l-lodicules; c-caryopsis; e-embryo. The spikelet parts illustrated have been reinterpreted by the author to be consistent with the text.

iate; palea similar to lemma, hyaline, 2.8–3.2 mm long; stamens 3; anthers purplish, 3–3.3 mm long; stigmas 2, separate, purple. Caryopsis not seen. Long-pedicelled spikelet 4–4.5 mm long, feminine (rarely bisexual), with a ring of rufous hairs at the base, the hairs 2–4 mm long; lower glume 3–3.5 mm long, chartaceous, glabrescent to pilose, 5–7-nerved, the nerves prominent; upper glume 2.8–3.2 mm long, membranous, glabrescent to pilose, 3–5-nerved, the nerves prominent; lemma hyaline, 2.5–3 mm long, shortly pilose, the margins ciliate; palea similar to lemma, 1.8–2.2 mm long, hyaline; stamens absent; stigmas 2, separate, purple. Caryopsis not seen.

Iconography. Stapf (1927).

Distribution. Brazil, Paraguay.

Eriochrysis filiformis is apparently rare in nature. Even when in bloom the plants are difficult to spot in the field because they grow in the densest parts of the permanently wet campos, mixed with many other grass species of similar habit and appearance. They usually grow in dense, widely scattered clumps. Populations in the Distrito Federal of Brazil grow in extremely boggy places. To reach the plants the collector has to walk across shaky ground almost as dangerous as quicksand. The plants apparently bloom only after having been burnt. All the collections examined displayed some sign of having been previously burnt. Since the typical habitat of this species, wet campo, is seldom subjected to seasonal fires, these plants rarely bloom.

Eriochrysis is related to the *Erianthus* Michaux/*Saccharum* groups. An account of the species of *Eriochrysis* is in preparation by the present author.

Specimens examined. BRAZIL. **Bahia:** Correntina, Fazenda Jatobá, 8 Aug. 1992, *M. A. Silva, T. S. Filgueiras & A. L. Brochado 1589* (IBGE, MO). **Distrito Federal:** APA do Rio São Bartolomeu, Córrego Mato Grande, 9 Sep. 1985, *Mendonça & Ribeiro 518* (BLA, CEN, IBGE, RB, SP, SPF, UEC); Cabeça de Veado [Jardim Botânico], 15 Sep. 1980, *Filgueiras 754* (IBGE, MAC); brejo próximo à Papuda, 10 Sep. 1985, *Filgueiras 1183* (IBGE). **Goiás:** entre Rio Torto et Paranan, s.a., *Glaziou 22444* (US, fragment). **Paraná:** Jaguariahyva [Jaguariaíva], 17 Feb. 1914, *Dusén 16051* (US); Ponta Grossa, 30 Jan. 1946, *Swallen 8366* (US). **São Paulo:** São José dos Campos, 28 Nov. 1961, *Mimura 142* (IBGE, SP); São Paulo, Avenida Paulista, 5 Nov. 1906, *Usteri s.n.* (SP 9575).

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A New Name in Mexican *Asclepias* (Asclepiadaceae)

Mark Fishbein
Herbarium and Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, Arizona 85721, U.S.A. Current address: Department of Botany, Washington State University, Pullman, Washington 99164, U.S.A.

ABSTRACT. *Asclepias lynchiana* Fishbein is proposed as a new name for the species commonly known as *A. grandiflora* E. Fournier, a later homonym of *A. grandiflora* L. f. The other available name for this species, *A. insignis* (Brandegee) Woodson, is a later homonym of *A. insignis* (Schlechter) Schlechter. *Asclepias lynchiana* has among the largest flowers of any North American species of *Asclepias* and is widely distributed from central to southern Mexico.

In the course of phylogenetic study of *Asclepias* (Fishbein, 1996), it became apparent that the species commonly known as *A. grandiflora* E. Fournier (see Woodson, 1954) lacks a legitimate name. Therefore, the following new name is proposed.

Asclepias lynchiana Fishbein, nom. nov. Replaced name: *Asclepias grandiflora* E. Fournier, Ann. Sci. Nat. Bot., ser. 6, 14: 379. 1882; not *Asclepias grandiflora* L. f., Suppl. Plant. 170. 1781. TYPE: Mexico, *Hahn s.n.* (holotype, P not seen).

Asclepiodora insignis Brandegee, Zoe 5: 253. 1908. *Asclepias insignis* (Brandegee) Woodson, Ann. Missouri Bot. Gard. 28: 207. 1941; not *Asclepias insignis* (Schlechter) Schlechter, J. Bot. 34: 455. 1896. TYPE: Mexico, *Purpus 2624* (holotype, UC not seen; isotype, MO not seen).

Asclepias lynchiana grows on rocky slopes, occasionally on limestone, in tropical deciduous forest, oak woodland, and pastures. It has been found in the Mexican states of Jalisco and Puebla south to Michoacán, Guerrero, and Oaxaca. Although widely distributed, populations of this species are apparently highly dispersed, judging by the relatively few specimens in herbaria. Some variation in flower morphology has been observed, especially in flower size (S. Lynch, pers. comm.), but no infraspecific taxa have been recognized. The species is closely related to *A. glaucescens* HBK and *A. crocea* Woodson, as noted by Woodson (1954), as well as to *A. elata* Bentham and *A. mirifica* Woodson (Fishbein, 1996).

This species has been known as *A. grandiflora* E. Fournier; however, use of the specific epithet was predated by *A. grandiflora* L. f. [= *Pachycarpus grandiflorus* (L. f.) E. Meyer]. In recognition of the illegitimate status of *A. grandiflora* E. Fournier, specimens at some herbaria have been annotated using the only other available name, *A. insignis* (Brandegee) Woodson. Unfortunately, this combination was published previously as *A. insignis* (Schlechter) Schlechter [= *Pachycarpus transversalis* (Schlechter) N. E. Brown; see Smith, 1988]. No other validly published names for this species have been found, necessitating the publication of the new name.

It is appropriate to rename this magnificent milkweed in honor of Steven P. Lynch, Louisiana State University at Shreveport. Lynch is the foremost student of Mexican *Asclepias*, and his assistance and encouragement have been invaluable to my research on the genus.

Acknowledgments. I thank John R. Reeder for his patient advice regarding taxonomic issues, and the staff at the University of Arizona Herbarium (ARIZ) for assistance in many aspects of my work. I am also grateful to the curators at MEXU, MO, and other herbaria for loans of specimens. This work was supported in part by funding from the Research Training Group in the Analysis of Biological Diversification, University of Arizona.

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Xenophyllum, a New Andean Genus Extracted from *Werneria* s.l. (Compositae: Senecioneae)

V. A. Funk

National Museum of Natural History, Department of Botany, Smithsonian Institution, MRC 166, Washington, D.C. 20560, U.S.A. Email: mnhbo003@sivm.si.edu

ABSTRACT. A new genus, *Xenophyllum*, is described, which consists of 21 species extracted from *Werneria* s.l. (Compositae: Senecioneae). All members of this new genus are mat- or hummock-forming perennials that grow at high elevations (3000–5200 m) in the Andes from Colombia to northern Argentina and northern Chile. Included is a brief description of the disposition of the species of *Werneria* s.l. and a preliminary key to those included in *Xenophyllum*.

Werneria s.l. is a genus of 40–50 species that grows in the high-elevation areas of the Western Hemisphere. All but one of the species are confined to the Andes and can be found from Mérida, Venezuela, to Patagonia. The one exception is *W. nubigena*, which is primarily South American but also has a few isolated populations in Mexico and northern Guatemala. The species historically included in *Werneria* s.l. are related to *Senecio* L. and its relatives. The character that is most frequently used to circumscribe *Werneria* s.l. is the connate fusion of the involucral bracts at least halfway up from the receptacle (Blake, 1928; Humboldt et al., 1820; Rockhausen, 1939; Weddell, 1856). However, the fusion of the involucral bracts varies a great deal; sometimes they are fused less than half their length in many of the species of *Werneria* s.l., and more than halfway in some members of *Senecio*. Also important is the fact that the fusion is partially a function of the maturity of the head, with some involucral bracts being fused at the base but splitting in late flowering or fruiting stages. One character that is consistent in *Werneria* s.l. is the lack of a calyculus; however, there are members of *Senecio* and related genera that lack a calyculus. Finally, all but three of the species have white ray florets (two have yellow and one has purple); all three colors are known in *Senecio*.

Although *Werneria* s.l. is probably not monophyletic, there are at least three identifiable groups within the genus that can be recognized as distinct genera. The first group consists of rosette-forming plants that are solitary or in small clumps. This group has 20–30 species and contains the type species, *Werneria nubigena* Kunth, and can now be referred to as *Werneria* s. str. A second group, the new genus *Misbrookea* V. A. Funk, is monotypic, with *M. strigossima* (A. Gray) V. A. Funk being its only member (Funk, 1997). The third group contains 21 species that form loose or tightly compressed hummocks or well-developed mats and have leaves along the rhizomes; these species are here moved into a new genus, *Xenophyllum* V. A. Funk.

KEY TO THE GENERA OF *WERNERIA* S.L.

1a. Leaves few and localized near the apex of the rhizome or just below the head; plants forming rosettes in small groups or often found individually; leaves completely green.
  2a. Leaves and involucre glabrous; apex of style with or without a few papillae but never with long multicellular hairs . . . . . *Werneria*
  2b. Leaves and involucre covered with long (3–5 mm) strigose hairs; apex of style with long multicellular hairs . . . . . *Misbrookea*
1b. Leaves numerous with at least the leaf bases covering the rhizomes for about 10 cm below the inflorescence or apex; plants forming tightly packed or loose hummocks or mats; leaves of the outer edges of the more closely compressed hummocks or mats with the distal few mm green, other leaves brown, blackish, or whitish . . . . . *Xenophyllum*

Xenophyllum V. A. Funk, gen. nov. TYPE: *Xenophyllum dactylophyllum* (Schultz Bipontinus) V. A. Funk, comb. nov.

Plantae perennes rhizomatosae tegetes vel aggeriformes, rhizoma in basibus foliorum persistentibus obtecta, folia caulini spirales base arcte contigua distaliter pervirida vel citrino-virida inferna atrobrunnea crassa. Capitula solitaria sessilia sin calyculo; involucrum glabrum, bracteis base connatis in anthesis vel ultra; radii feminei albi (praeter in radiis violaceis *X. rosei*), flosculi disci hermaphroditi lutei vel albi; styli lutei vel rubri.

Hab. in montibus altis, e Colombia ad andinam Argentinensis et Chilensis.

Plants rhizomatous, forming loose or tight hummocks or well-developed mats. Rhizomes covered with leaves or leaf bases. Leaves spirally arranged and tightly packed, appressed at least at the leaf base, upper leaves deep or bright yellow green and lower leaves dark brown, leaves thick in cross section or if

flat then very small with a divided apex. Capitula solitary, without a calyculus. Involucre glabrous, bracts connately fused from the base, at least during flowering. Ray florets showy (except *X. esquilachense*, which has a reduced corolla), fertile, white (except for *X. roseum*, which has violet-purple ray florets that fade with age to pink). Disk florets hermaphroditic, yellow or white; styles yellow or red, the apex truncate to slightly acute or rounded with tufts of papillae near edges. Pappus of many whitish bristles; achenes dark with 7–9 ribs, pyriform.

High mountains of the Andes from Colombia to northern Argentina and Chile.

In comparison to other members of the Compositae, the species in *Xenophyllum* have unusual habits and odd leaves. No doubt this is the result of the fact that the species grow at high elevations, most at the very limit of the vegetation, from central and southern Colombia to northern Argentina and northern Chile, very nearly between the equator and the Tropic of Capricorn. Although small in stature in comparison to the more spectacular members of the family, such as the silverswords of Hawaii (*Agyroxyphium*) and the Espeletiinae of the northern Andes, they nevertheless have equally unusual vegetative characteristics.

The members of *Xenophyllum* are distinctive because of their leaves, hence the name (xeno = strange or foreign, and phyllum = leaves). Some species have needle-like leaves (e.g., *X. humile*, Fig. 1A), others have leaves that are triangular in cross section (e.g., *X. marcidum*, Fig. 1B), and still others have leaves that are round in cross section at the base but divided into two or more parts at the apex (e.g., *X. pseudodigitatum*, Fig. 1C). These three figures illustrate just a few of the many strange leaves in this group; among the other leaf types are flattened leaves divided at the apex, and leaves divided into finger-like projections. Some of the species names reflect the superficial similarity of the leaves to other taxonomic groups, such as, *Werneria lycopodioides*, *W. juniperensis*, and *W. leucobryoides*, or body parts such as *W. digitata* and *W. pseudodigitata*.

Xenophyllum divides into three groups, one that is more northern and two more southern. The northern species group, centered on the species *Xenophyllum humile*, has been collected primarily in Colombia and Ecuador but also from northern Peru, and one recent disjunct was collected by S. Beck in a páramo type habitat in Bolivia. The species of this northern group grow in tight or somewhat loose hummocks or mats in more or less wet páramos, except for *X. rigidum*, which grows on the upper dry slopes of a few volcanoes. I have collected five of the six species in this northern group—they are easy to recognize, closely related, and most likely form a natural group. The odd species currently included in this group is the one I have not collected, *X. acerosum*, which is known only from the type collection in southern Ecuador. *Xenophyllum acerosum* is clearly different from the other five species; however, it is poorly understood and its final subgeneric placement will have to await further information.

Both of the two more southern groups are found in southern Peru, Bolivia, and northern Argentina and Chile. One group is centered on the species *X. dactylophyllum* and has leaves that are divided at the apex. This divided leaf group is found primarily on dry rocky slopes near glaciers. The second southern group is centered on the species *X. poposum* and has undivided leaves that are sometimes terete, and other times angular in cross section; when angular they are as thick as they are wide. A few species have leaves that are somewhat flattened near the apex. The members of this last southern group grow at very high elevations (ca. 5000 m) in dry rocky areas and on glacial moraines. I have collected only 7 of the 15 species in the two southern groups: many are known from only one or a few collections and are, therefore, less well studied.

Members of all three groups are usually part of the very highest patches of vegetation on the windswept slopes of the Andes.

A revision of the genus *Xenophyllum* is under way, but the detailed descriptions are completed for only about half of the species. The imminent publication of other articles using the new names necessitates the description of the genus prior to the publication of the monograph. While it is difficult to produce a detailed key at this time, a preliminary one is offered that should help with species determinations.

PRELIMINARY KEY TO THE SPECIES OF *XENOPHYLLUM*

1a. Leaves undivided, entire.
  2a. Ray florets violet-purple fading through various shades to pale lavender in late flowering and fruiting stages . . . . . *X. roseum*
  2b. Ray florets white.
    3a. Leaves angular in cross section, width and depth ± equal.
      4a. Erect, growing out of sand in small clumps on slopes; involucre dark purple; only known from dry puna area of the tri-country border of Peru, Chile, and Bolivia . . . . *X. lycopodioides*
      4b. Prostrate, growing on rocks in mats in glacial melt streams; involucre green or with purple

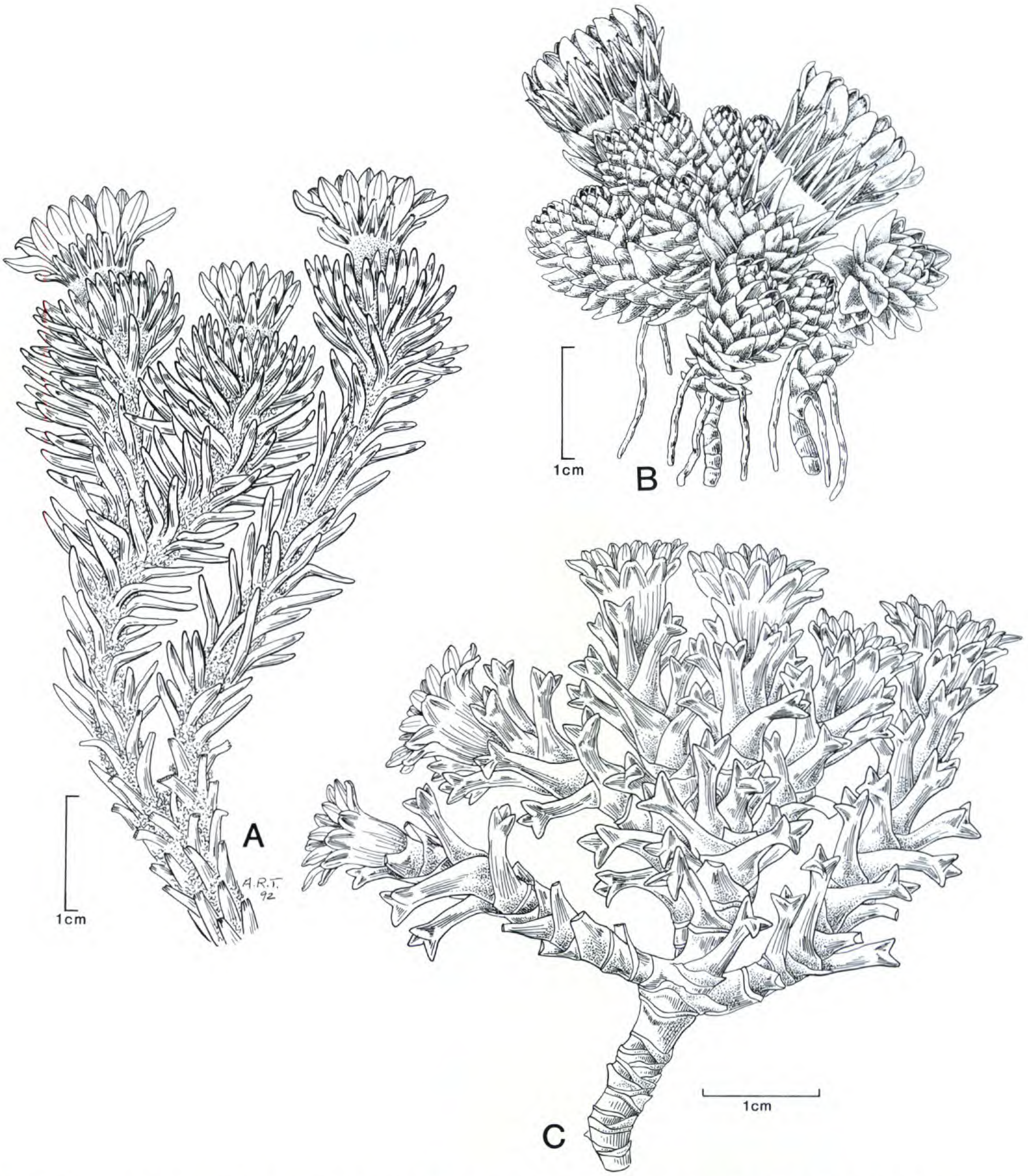

Figure 1. —A. *Xenophyllum humile* (Kunth) V. Funk. —B. *Xenophyllum marcidum* (S. F. Blake) V. A. Funk. —C. *Xenophyllum pseudodigitatum* (Rockhausen) V. A. Funk. All drawings by Alice Tangerini (US).

borders, but not completely purple; known from two areas, one in northern Bolivia and the other in southern Peru . . . . . *X. marcidum*

3b. Leaves terete, sometimes slightly elliptical in cross section.

5a. Leaves spiny and needle-like; plants with lower rhizomes bare of leaves; erect, forming loose hummocks . . . . . *X. acerosum*

5b. Leaves fleshy, almost succulent; plants with at least the leaf bases attached nearly all the way to base of rhizome; erect or flattened forming hummocks or mats.

6a. Plants forming tight hummocks or loose, more open hummocks but all rhizomes erect; leaf bases usually without long hairs that wrap around rhizome (*X. poposum* occasionally has such hairs).

7a. Plants growing in wet páramo from Colombia, Ecuador, and northern Peru.

8a. Plants in rounded hummocks; leaves slightly elliptical in cross section,

brown to dark brown or black except for the distal sections of the uppermost leaves, which are bright to medium green; heads medium-sized (20–30 disk florets); leaves usually 10–20 mm long (sometimes 7–25 mm); Colombia to northern Peru (one isolated collection in Bolivia).

9a. Leaves short, 7–11 mm long, triangular with a rounded-acuminate apex; plants forming small hummocks in very wet areas; occasional in southern Colombia . . . . . *X. fontii*

9b. Leaves longer, (8–)12–25 mm long, cylindrical, tapering to a rounded-acute apex; plants in large, tightly packed hummocks on slopes; common, especially in northern and central Ecuador . . . . . *X. humile*

8b. Plants in loose, more flattened hummocks; leaves round in cross section, very light brown to white except for the distal 2–3 mm of the uppermost leaves, which are medium green; heads small (11–13 disk florets); leaves 5.0–6.5 mm long; southern Ecuador . . . . . *X. sotarense*

7b. Plants in dry puna from southern Peru, Bolivia, northern Argentina and northern Chile.

10a. Leaves narrowing toward apex but ending abruptly in a flat callused tip . . . . . *X. poposum*

10b. Leaves narrowing gradually to an acute or rounded tip.

11a. Leaves arching outward . . . . . *X. ciliolatum*

11b. Leaves straight, appressed . . . . . *X. weddellii*

6b. Plants forming ± flat mats; leaf bases with long hairs that wrap around rhizomes.

12a. Leaves rather thin, medium green, reflected just below the head, apex tapering to a point; heads with 90–120 disk florets; common in northern Ecuador and occasional in Colombia . . . . . *X. crassum*

12b. Leaves thick, dark green, stiff and erect, apex rounded; heads with 40–50 disk florets; known only from the Ecuadorian volcanoes Chimborazo and Antisana . . . . . *X. rigidum*

1b. Leaves forked, notched, or digit-like at the apex.

13a. Corolla of the rays absent or greatly reduced . . . . . *X. esquilachense*

13b. Corolla of the rays conspicuous.

14a. Leaves terete just below divisions; leaf upper portion divided in 3, 9, or many.

15a. Upper portion divided into 3 or 9 parts, apices of leaves pointed; northern Argentina . . . . . *X. pseudodigitatum*

15b. Leaf divisions in 3, 9, or many, apices of leaves appearing rolled in at the tips; Bolivia and southern Peru.

16a. Leaf apices in 3 or 9; plants in hummocks, ca. 10–30 cm tall; relatively common in certain areas of southern Peru and northern Bolivia . . . . . *X. dactylophyllum*

16b. Leaf apices in many parts but in multiples of 3; plants in smaller but taller hummocks, ca. 20–60 cm tall; rare, known only from two localities in southern Peru . . . *X. staffordiae*

14b. Leaves ± flattened just below divisions; leaf upper portion divided into 2 or 3.

17a. Leaves divided into 2 parts at apex . . . . . *X. digitatum*

17b. Leaves divided into 3 parts at apex.

18a. Leaves thin, herbaceous; leaf divisions obvious.

19a. Leaves divided nearly halfway, divisions narrow, margins glabrous . . . . . *X. rosenii*

19b. Leaves divided only a small amount, divisions broad and very flat, margins of basal portion of leaf with short, evenly spaced hairs . . . . . *X. decorum*

18b. Leaves thick, nearly fleshy; leaf divisions minute.

20a. Leaves very small, 4–6 mm long . . . . . *X. amblydactylum*

20b. Leaves larger, 10–12 mm long . . . . . *X. incisum*

SPECIES OF *XENOPHYLLUM* V. A. FUNK (INCLUDES ONLY COMMONLY USED SYNONYMS; ACCEPTED NAMES IN BOLDFACE)

1. Xenophyllum acerosum (Cuatrecasas) V. A. Funk, comb. nov. Basionym: *Werneria acerosa* Cuatrecasas, Brittonia 8: 45. 1954. TYPE: Ecuador. Azuay: Oriente border, eastern Cordillera between Oña and Río Yacuambi, crest 10,000–11,200 ft., Sep. 1945, *Prieto P-280* (holotype, F; isotypes, G, GH, MO, NY, P, UC, US; photo of holotype, US). Known only from type collection.

2. Xenophyllum amblydactylum (S. F. Blake) V. A. Funk, comb. nov. Basionym: *Werneria amblydactyla* S. F. Blake, J. Wash. Acad. Sci. 18: 490. 1928. TYPE: Peru. Alpamarca, in the Andes, s.d., *Wilkes s.n.* (holotype, US). Peru.

Werneria articulata S. F. Blake. Contr. U.S. Natl. Herb. 22: 651. 1924. (= *X. humile*). TYPE: Ecuador. Pichincha: crescit locis uliginosis in Páramo de Mojanduleur [Mojanda], 3400–4000 m, 1880 *Lehmann 6230* (syntype, B [destroyed]; lectotype, designated here, K; fragment of B, MA, US; photo of K, US).

3. Xenophyllum ciliolatum (A. Gray) V. A. Funk, comb. nov. Basionym: *Werneria ciliolata* A. Gray, Proc. Amer. Acad. Arts 5: 140. 1861. TYPE: Peru. Casa Cancha, Andes of Peru, *Wilkes s.n.* (holotype, US). Bolivia, Chile, and Peru.

4. Xenophyllum crassum (S. F. Blake) V. A. Funk, comb. nov. Basionym: *Werneria crassa* S. F. Blake, J. Wash. Acad. Sci. 18: 495. 1928. TYPE: Colombia. Caldas: Páramo del Quindo, swale along stream, 3700–4200 m, 15–20 Aug. 1922, *Pennell & Hazen 10031* (holotype, US not seen [records indicate it may have been destroyed while on loan to B]; lectotype, designated here, K; isolectotypes, GH, NY). Colombia and Ecuador.

5. Xenophyllum dactylophyllum (Schultz Bipontinus) V. A. Funk, comb. nov. Basionym: *Werneria dactylophylla* Schultz Bipontinus, Bonplandia 4: 53. 1856. TYPE: Peru. [Dept. Puno], Prov. Carabaya, Cordillera above Agapata, 16,000 ft., June 1854, *Lechler 1807* (holotype, B [destroyed]; lectotype, designated here, G; isolectotypes, BR, GH(pp), GOET, K, LE(pp), NY, P—4 sheets, W—2 sheets; photo of B specimen, GH, NY, US).

6. Xenophyllum decorum (S. F. Blake) V. A. Funk, comb. nov. Basionym: *Werneria decora* S. F. Blake, J. Wash. Acad. Sci. 18: 491. 1928. TYPE: Peru. Dept. Lima: Casapalca, in loose soils of alpine basin slopes, 4725 m, 21 May 1922, *Macbride & Featherstone 849* (holotype, F; isotypes, G, GH, US; photo of holotype, US). Peru.

Werneria decumbens Hieronymus, Bot. Jahrb. Syst. 21: 364. 1896 (probably = *Xenophyllum weddellii*). TYPE: Peru. Viaje de Tacora á Tomarape, 4200–4400 m, Oct. 1876, *Stubel 100c* (holotype, B [destroyed]; photo of B, GH, NY, US).

7. Xenophyllum digitatum (Weddell) V. A. Funk, comb. nov. Basionym: *Werneria digitata* Weddell, Chloris Andina 1: 86. 1856. TYPE: Bolivia. [Dept. Potosi], lagunas de Potosi, *d'Orbigny 1407* (lectotype, designated here, P; isolectotypes, BR, G not seen, P; fragment of G, F). Bolivia and Peru.

8. Xenophyllum esquilachense (Cuatrecasas) V. A. Funk, comb. nov. Basionym: *Werneria esquilachensis* Cuatrecasas, Brittonia 8: 192. 1956. TYPE: Peru. Dept. Puno: San Antonio de Esquilache, on sandy ledges above rocks, 15,500 ft., 12 May 1937, *Stafford 716* (holotype, K; photo of K, US). Known only from type collection.

9. Xenophyllum fontii (Cuatrecasas) V. A. Funk, comb. nov. Basionym: *Werneria fontii* Cuatrecasas, Trab. Mus. Nac. Ci. Nat., Ser. Bot. (Madrid) 29: 42–43. 1935. TYPE: Colombia. Tolima: Páramo del Tolima, 4200 m, 15 May 1932, *Cuatrecasas 2862* (holotype, MA; isotypes, MA—2 sheets, F, K). Colombia: Caldas and Tolima.

10. Xenophyllum humile (Kunth) V. A. Funk, comb. nov. Basionym: *Werneria humilis* Kunth in HBK, Nov. Gen. Spec. Plant. 4: 150. 1820. TYPE: Andes above Quito, 3600–4000 m, s.d., *Bonpland s.n.* (holotype, P not seen, microfiche IDC 106.III.4; fragment of holotype, F; isotypes, B-W not seen, microfiche no. 16433, IDC 1185.II.2, P; photo of holotype, US). Primarily in Colombia and Ecuador with a few in northern Peru and one collection in Bolivia.

11. Xenophyllum incisum (Philippi) V. A. Funk, comb. nov. Basionym: *Werneria incisa* Philippi, Anales Mus. Nac. Chile, Bot. 8: 41. 1891. TYPE: Chile. [Between Copacoya and Inacaliri], *Philippi s.n.* (holotype, SGO; isotypes, B [destroyed], GOET, K, US; photo of B, GH, NY, US; fragment of K, US). Argentina and Chile.

Werneria juniperina Hieronymus, Bot. Jahrb. Syst. 21: 365. 1896 (probably = *Xenophyllum ciliolatum*). TYPE: Peru. [Peru–Chile–Bolivia border], between Tacora and Sajama, 4200–4300 m, Oct. 1876, *Stubel 106* (lectotype, designated here, B [destroyed]; photo of B, GH, NY, US).

Werneria leucobryoides S. F. Blake, J. Wash. Acad. Sci. 18: 494. 1928 (= *Xenophyllum sotarense*). TYPE: Ecuador. Mount Quilindaña, at level of perpetual snow, Dec. 1897, *Sodiro s.n.* (holotype, NY; isotypes, G, P; photo of NY, GH, US; fragment of NY, US). There are two sheets at P that have "Quilindana" on label but no collector or number; no decision has been made on whether or not they are isotypes.

12. Xenophyllum lycopodioides (S. F. Blake) V. A. Funk, comb. nov. Basionym: *Werneria lycopodioides* S. F. Blake, J. Wash. Acad. Sci. 18: 493. 1928. TYPE: Chile [now Peru], Prov. Tacna, Dept. Tacna, Cordillera Volcán Tacora, Quiñuta, 5000 m, Apr. 1926, *Werdermann 1164* (holotype, GH; isotypes, B, BM, CAS, F, G, MO, NY, UC, US; photo of F, US; photo of GH, NY, US; fragment of GH, US).

13. Xenophyllum marcidum (S. F. Blake) V. A. Funk, comb. nov. Basionym: *Werneria marcida* S. F. Blake, J. Wash. Acad. Sci. 18: 492. 1928. TYPE: Peru. [Dept. Lima], Rio Blanco, in mounds by brook, 15,000 ft., 20–25 Mar. 1923, *MacBride 3032* (holotype, F; isotypes, BM, G—2 sheets, GH, MA, US, W; photo of F, US—2 sheets). Bolivia and Peru.

14. Xenophyllum poposum (Philippi) V. A. Funk, comb. nov. Basionym: *Werneria poposa* Philippi, Anales Mus. Nac. Chile, Bot. 8: 40. 1891. TYPE: Chile. Copacoya, 3500 m, s.d., *Philippi s.n.* (holotype, SGO). Argentina, Bolivia, Chile, and Peru.

Werneria popposa is a common misspelling of *Werneria poposa.*

15. Xenophyllum pseudodigitatum (Rockhausen) V. A. Funk, comb. nov. Basionym: *Werneria pseudodigitata* Rockhausen, Bot. Jahrb. Syst. 70: 288. 1939. TYPE: Argentina. Salta: Umgebung des Nevado del Castillo, 10,000–15,000 ft., 19–23 Mar. 1873, *Lorentz & Hieronymus 96* (holotype, B [destroyed]; lectotype, designated here, GOET; isolectotype, K; photo of B, GY, NY, TEX, US). Argentina.

16. Xenophyllum rigidum (Kunth) V. A. Funk, comb. nov. Basionym: *Werneria rigida* Kunth in HBK, Nov. Gen. Spec. Plant. 4: 149. 1820. TYPE: Ecuador. Andes of Quito, 3600–4000 m, *Bonpland s.n.* (holotype, P not seen, microfiche IDC 106.III.3; isotypes, B-W, microfiche no. 16432 IDC 1185.II.1, F, P—2 sheets; fragment of P specimen, F; photo of P sheet, US). Ecuador, Volcanoes Antisana, Chimborazo, and possibly Pinchincha.

17. Xenophyllum rosenii (R. E. Fries) V. A. Funk, comb. nov. Basionym: *Werneria rosenii* R. E. Fries, Nova Acta Regiae Soc. Sci. Upsal., ser. 4, vol. 1, no. 1: 90, plate IV fig. 7. 1905. TYPE: Argentina. Jujuy: Nevado de Chañi, ca. 5200 m, 29 Nov. 1901, *Fries 862* (holotype, UPS not seen; isotypes, P, US; photo of P, US). Northern Argentina and Bolivia.

18. Xenophyllum roseum (Hieronymus) V. A. Funk, comb. nov. Basionym: *Werneria rosea* Hieronymus, Bot. Jahrb. Syst. 28: 648. 1901. TYPE: Ecuador. Azuay: Paramo de Cajas, 3800–4300 m, Nov. 1880, *Lehmann 5687* (holotype, B [destroyed]; lectotype, designated here, K; isolectotype, US; fragment of B, MA; photo of B, GH, NY, US).

Werneria sedoides S. F. Blake, J. Wash. Acad. Sci. 18: 493. 1928 (= *Xenophyllum marcidium*). TYPE: Peru. Dept. Huánuco: Punco, 21 mi. W of Huallanca, in tufts on wet rocky slopes, 13,500 ft., 1 Oct. 1922, *MacBride & Featherstone 2475* (holotype, F; isotypes, G, US; fragment of holotype, G).

19. Xenophyllum sotarense (Hieronymus) V. A. Funk, comb. nov. Basionym: *Werneria sotarensis* Hieronymus, Bot. Jahrb. Syst. 21: 363. 1896. TYPE: Colombia. Cauca: on the peak of Sotara, 4400 m, June 1870, *Stubel 339b* (holotype, B [destroyed]; lectotype, designated here, MA; photo of B, GH, NY, US).

Werneria soratensis is a common misspelling of *Werneria sotarensis.*

20. Xenophyllum staffordiae (Sandwith) V. A. Funk, comb. nov. Basionym: *Werneria staffordiae* Sandwith, Hooker's Icon. Pl., ser. 5, 5: 1–2. pl. 3424. 1950. TYPE: Peru. Puno: San Antonio de Esquilache, on dry bare slopes below a wall of rock, 4650 m, 14 May 1937, *Stafford 734* (holotype, K; isotypes, BM, F). Rare in southern Peru and possibly Bolivia.

21. Xenophyllum weddellii (Philippi) V. A. Funk, comb. nov. Basionym: *Werneria weddellii* Philippi, Anales Mus. Nac. Chile, Bot. 8: 40. 1891. TYPE: Chile. Tarapacá: Laguna del Huasco [Laguna del Guasco, 3766 m], 1 Mar. 1885, *Philippi s.n.* (holotype, SGO; isotypes, B [destroyed], K, US; photo of B, GH, NY, US; fragment of K, US; photo of K, US). Near the tri-national border of Bolivia, Chile, and Peru.

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QCNE, SGO, SMF, TEX, UC, W, and the herbarium of the University of Azuay. *Werneria* s.l. is extremely difficult to study using only herbarium material, so fieldwork has been essential for gaining the proper insight into the morphology. The fieldwork for the revision has been paid for by grants from the National Geographic Society and three funds from the Smithsonian Institution: the Research Opportunities Fund and the Lowland Tropical Ecosystems Fund from the National Museum of Natural History, and the Scholarly Studies Program of the Office of Fellowships and Grants.

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Typification of Names in *Ancistrocladus* Wallich (Ancistrocladaceae)

Roy E. Gereau
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. Details of typification are presented for 25 of the 27 existing binomials in *Ancistrocladus* Wallich (Ancistrocladaceae). Holotypes are indicated for *A. carallioides* Craib, *A. congolensis* J. Léonard, *A. ealaensis* J. Léonard, *A. extensus* Wallich ex Planchon, *A. griffithii* Planchon, *A. guineensis* Oliver, *Wormia hamata* Vahl [≡ *A. hamatus* (Vahl) Gilg, *A. vahlii* Arnott], *A. harmandii* Gagnepain, *A. heyneanus* Wallich ex J. Graham, *A. korupensis* D. W. Thomas & Gereau, *A. letestui* Pellegrin, *A. likokoi* J. Léonard, *A. pachyrrhachis* Airy Shaw, *A. pinangianus* Wallich ex Planchon, *A. robertsoniorum* J. Léonard, *Bembix tectoria* Loureiro [≡ *A. tectorius* (Loureiro) Merrill], *A. thwaitesii* Tieghem, *A. uncinatus* Hutchinson & Dalziel, and *A. wallichii* Planchon. Previously designated lectotypes are indicated for *A. abbreviatus* Airy Shaw and *A. barteri* Scott-Elliot, lectotypes are newly designated for *A. attenuatus* Dyer and *A. cochinchinensis* Gagnepain, and the probable need for neotypification of *A. hainanensis* Hayata is discussed. Two names, *A. pentagynus* Warburg and *A. sagittatus* Wallich ex Planchon, are excluded from the genus.

Ancistrocladus Wallich (Ancistrocladaceae) is a genus of approximately 20 known species, 9 in tropical Asia and 11 in tropical Africa (Thomas & Gereau, 1993). Twenty-seven binomials have been published in the genus, but subsequent to the synopsis presented by Gilg (1925), no overview of *Ancistrocladus* throughout its range has appeared. In anticipation of the monograph of the genus now in progress, details of typification of 25 binomials in *Ancistrocladus* are provided, while 2 binomials are excluded from the genus. Although references to published taxonomic synonymy of some of the Asian species are included in the discussions of individual names, no attempt is made to elucidate taxonomic relationships in the present work.

Although the genus *Ancistrocladus* is conserved as a *nomen novum* published by Wallich (1828–1849), the binomials first proposed in that work were not validated by descriptions and are thus *nomina nuda* unless they were subsequently effectively and validly published (de Candolle & Radcliffe-Smith, 1981: 345). In a number of cases, type specimens have been indicated in the following format:

Ancistrocladus extensus Wallich ex Planchon, Ann. Sci. Nat. Bot., Sér. 3, 13: 318. 1849. TYPE: "Amherst, prov. Martaban" (Burma) [Wallich, Numer. List 1052.1. 1829] (holotype, K; isotypes, BM, K, K-WALL).

In this example, the authorities and first literature citation refer to the validation by Planchon in 1849 of a binomial proposed by Wallich. The type locality in quotations is as written on the isotype in K-WALL (the Herbarium of the Honourable East India Company, maintained as a separate collection at K) and interpreted by Planchon. The citation in square brackets is a reference to both the set of specimens distributed as *Wallich 1052.1* and to the publication of the epithet in the *Numerical List* in 1829. As explained by de Candolle and Radcliffe-Smith (1981: 344), the specimens now housed in K-WALL are unlikely to have been the duplicates available to most authors who validated Wallich's names; the K-WALL duplicates have thus been considered isotypes rather than holotypes in all of the following cases.

NOMENCLATOR

Ancistrocladus Wallich, Numer. List. 1052. 1829. (Nom. conserv.) TYPE (listed in ICBN Appendix IIIA and thus protected under Art. 14.8): *Ancistrocladus hamatus* (Vahl) Gilg (≡ *Wormia hamata* Vahl).

≡ *Wormia* Vahl, Skr. Naturhist.-Selsk. 6: 105. 1810 (hom. illegit., non *Wormia* Rottboell [Dilleniaceae], Nye Saml. Kongel. Danske Vidensk. Selsk. Skr. 2: 532. 1783).

= *Bembix* Loureiro, Fl. cochinch. 259, 282. 1790. (Nom. rejic.) TYPE: *Bembix tectoria* Loureiro

Note. In the following citations, names of collectors appear under each binomial exactly as published in the protologue. In discussions of specimens following the formal citations, names appear as written on herbarium labels.

Ancistrocladus abbreviatus Airy Shaw, Kew Bull. 1949: 67. 1949. TYPE: Sierra Leone. Njala, *Deighton 2589* (lectotype, designated by Airy Shaw (Kew Bull. 1950: 148. 1950), K; isolectotypes, BM, P).

Ancistrocladus attenuatus Dyer, in Hooker f., Fl. Brit. India 1: 300. 1874. TYPE: Tenasserim and Andaman Islands, *Helfer s.n., Kew Distrib. 724* (lectotype, designated here, K; isotypes, C, GH, K, L, P).

At K there are two specimens identically labeled "Herbarium of the late East India Company No. 724, *Ancistrocladus attenuatus* Dyer, TENASSERIM and ANDAMANS. Herb. Helfer. Distributed at the Royal Gardens, Kew. 1861-2." Both bear a red "Type Specimen" label and are stamped "HERBARIUM HOOKERIANUM 1867." I here designate the specimen with a detached infructescence bearing fruits with partially developed wings as the lectotype.

Ancistrocladus barteri Scott-Elliot, J. Linn. Soc., Bot. 30: 73. 1894. TYPE: Sierra Leone. Mount Gonkwi, Duunia, Talla Hills, *Scott Elliot 4860* (lectotype, designated by Airy Shaw (Kew Bull. 1950: 148. 1950), K; isolectotype, BM).

Ancistrocladus carallioides Craib, Bull. Misc. Inform. 1925: 19. 1925. TYPE: Thailand. Nan: Doi Tiu, *Kerr 5053* (holotype, K; isotype, BM).

Ancistrocladus cochinchinensis Gagnepain, Notul. Syst. (Paris) 1: 115. 1909. SYNTYPES: Vietnam. Bin dinh, *Pierre 16* (lectotype, designated here, P [fl]; isolectotypes, A, C, K, L, P [fr], US); Prov. Bien hoa, Tri huyen, *Pierre 1716* (not seen), *1731* (A, C, L, P), *1732* (K, P).

None of the syntypes examined was in conflict with the description in the protologue of *Ancistrocladus cochinchinensis*, and so I have designated the highest quality duplicate of the most widely distributed collection as the lectotype. At P there are two specimens labeled *Pierre 16*, one in late flower and one in fruit. The fruiting specimen bears the locality data "in sylvis ad Tri in prov. Bien Hoa," corresponding to the locality given by Gagnepain for *Pierre 1716*, *1731*, and *1732*. The flowering specimen bears the locality "in montibus Binh Dinh," in agreement with the locality given in the protologue for *Pierre 16*. I therefore have designated the flowering specimen at P as the lectotype.

Ancistrocladus congolensis J. Léonard, Bull. Soc. Roy. Bot. Belgique 82: 33. 1949. TYPE: Zaïre. Forestier Central, Yafunga sur Zaïre, près d'Isangi, *Louis 11171* (holotype, BR; isotypes, BM, BR, K, P).

At BR there are two specimens labeled *Louis 11171*, both in good condition and with mature fruit. The specimen with a typewritten label and annotated "*Ancistrocladus congolensis* J. Léonard, Determinavit Léonard 12/48 et 3/1982" is here considered the holotype, while the specimen with a handwritten label and no dated annotation is here considered an isotype.

Ancistrocladus ealaensis J. Léonard, Bull. Soc. Roy. Bot. Belgique 82: 30. 1949. TYPE: Zaïre. Forestier Central, env. d'Eala, rivière Yuli, *J. Léonard 1057* (holotype, BR; isotypes, BR, K, P, YBI not seen).

At BR there are two specimens labeled *J. Léonard 1057*. As for *Ancistrocladus congolensis*, the specimen bearing a typewritten label and a dated annotation by Léonard is here considered the holotype.

Ancistrocladus extensus Wallich ex Planchon, Ann. Sci. Nat. Bot., Sér. 3, 13: 318. 1849. TYPE: "Amherst, prov. Martaban" (Burma) [Wallich, Numer. List 1052.1. 1829] (holotype, K; isotypes, BM, K, K-WALL).

The holotype of *Ancistrocladus extensus* is the specimen at K stamped "HERBARIUM HOOKERIANUM 1867" and bearing a lithographed label from Wallich's *Numerical List* on which is written "1052 *Ancistrocladus extensus*, Wall Ad hoc genus pertinet *Wormia*, Vahl in act. soc. hist. nat. hafn. vol 6. p 104 (haud Rottb.) 1 Amherst 1827 2 Pundua, F. D Silva. An ullo modo distinctus?"

An identically labeled specimen in K-WALL bears a microfiche number 1052.1, corresponding to the type locality of *A. extensus* and the first numbered locality on Wallich's label. Van Steenis (1948) considered *A. extensus* a taxonomic synonym of *A. tectorius*.

Ancistrocladus griffithii Planchon, Ann. Sci. Nat. Bot., Sér. 3, 13: 318. 1849. TYPE: "Mergui" (Burma), *Griffith s.n.* (holotype, K; isotype, P).

Ancistrocladus guineensis Oliver, Fl. trop. Afr. 1: 175. 1868. TYPE: Nigeria. Calabar, *Mann 2234* (holotype, K; isotypes, GH, P).

Ancistrocladus hainanensis Hayata, Icon. pl. formos. 3: 46. 1913. TYPE: Hainan, *Z. Katsumada s.n.* (not seen).

After examining material on loan from a large number of herbaria, including KYO, SING, and TI, I have not found the above-cited type. I prefer to delay the neotypification of *Ancistrocladus hainanensis* until all materials have been examined for the monograph of the genus. Van Steenis (1948) considered *A. hainanensis* a taxonomic synonym of *A. tectorius.*

Ancistrocladus hamatus (Vahl) Gilg, Nat. Pflanzenfam. 3(6): 276. 1895. *Wormia hamata* Vahl, Skr. Naturhist.-Selsk. 6: 105. 1810. *Ancistrocladus vahlii* Arnott, Nova Acta Phys.-Med. Acad. Caes. Leop.-Carol. Nat. Cur. 18: 325. 1836. Nom. superfl. illegit. TYPE: Sri Lanka, près de Bigamen, *Koenig s.n.* (holotype, C; isotypes, A, C, BM, L, P).

At C there are three specimens filed in the type folder of *Wormia hamata* and labeled "Recorded in the catalogue of the Koenig collections." The specimen stamped "HB. VAHLII" bears both extensive annotations in Vahl's hand (compared with Vahl sample f in Burdet, 1979) and a sketch of the plant's habit, and is here considered the holotype.

Ancistrocladus harmandii Gagnepain, Notul. Syst. (Paris) 1: 114. 1909. TYPE: Laos. Koukou: bassin du Sé-moun, *Harmand 989* (holotype, P; isotype, K).

Ancistrocladus heyneanus Wallich ex J. Graham, Cat. pl. Bombay 28. 1839. TYPE: "Herb. Heyne" [Wallich, Numer. List 7262. 1832] (holotype, K; isotypes, C, K-WALL).

Ramamoorthy (1976) suggested that *Ancistrocladus heyneanus* may be a taxonomic synonym of *A. hamatus.*

Ancistrocladus korupensis D. W. Thomas & Gereau, Novon 3: 494. 1993. TYPE: Cameroon. Southwest Prov.: Ndian Div., 0.6 km E of confluence of Mededibe (Moliba) and Ndian (Mana) Rivers, *Gereau et al. 5180* (holotype, MO; isotypes, K, P, SCA, YA).

Ancistrocladus letestui Pellegrin, Bull. Soc. Bot. France 98: 18. 1951. TYPE: Gabon. Lastoursville: monts Iboundji, *LeTestu 8627* (holotype, P; isotypes, BM, BR, EA).

Ancistrocladus likokoi J. Léonard, Bull. Soc. Roy. Bot. Belgique 82: 34. 1949 [as "*likoko*"]. TYPE: Zaïre. Forestier Central, rivière Boamba, env. de Yangambi, *J. Léonard 1850* (holotype, BR; isotypes, BR, P, YBI not seen).

In the protologue, Léonard stated, "Cette espèce est dédiée au brave LIKOKO, indicateur à la Division de Botanique de l'INÉAC à Yangambi." It is thus necessary under ICBN Art. 60.11 (Greuter et al., 1994: 74) to correct the orthography of the specific epithet as above. There are three specimens at BR labeled *J. Léonard 1850.* As in the case of *Ancistrocladus congolensis* and *A. ealaensis,* the specimen bearing a typewritten label and a dated annotation by Léonard is here considered the holotype.

Ancistrocladus pachyrrhachis Airy Shaw, Kew Bull. 1950: 149. 1950. TYPE: Liberia. Montserrado: Monrovia, *J. T. Baldwin Jr. 5839* (holotype, K [Sheet 1]; isotypes, K [Sheets 2–4]).

At K there are four specimens labeled *J. T. Baldwin 5839.* The upper right corner of each label is marked with a handwritten sheet number. Sheet 1, bearing Airy Shaw's handwritten annotation dated 6.ix.49 and a red "Type Specimen" label, is here considered the holotype.

Ancistrocladus pinangianus Wallich ex Planchon, Ann. Sci. Nat. Bot., Sér. 3, 13. 318. 1849. TYPE: Penang (Malaysia), *G. Porter s.n.* [Wallich, Numer. List 1054. 1829] (holotype, K; isotypes, BR, C, K, K-WALL, P).

The specimen at K bearing Wallich's lithographed label number 1054 and stamped "HERBARIUM HOOKERIANUM 1867" is here considered the holotype of *Ancistrocladus pinangianus.* Another specimen at K with the handwritten annotation "*Ancistrocladus Penangianus* Wall, Penang Wallich 1829, H. I. 1054" and stamped "HERBARIUM BENTHAMIANUM 1854" is an isotype. Van Steenis (1948) considered *A. pinangianus* a taxonomic synonym of *A. tectorius.*

Ancistrocladus robertsoniorum J. Léonard, Bull. Jard. Bot. Belg. 54: 466. 1984. TYPE: Kenya. Kwale Dist.: Buda Forest, *Robertson 3687* (holotype, BR; isotype, BR).

At BR there are two specimens labeled *S. A. Robertson 3687.* As in the case of *Ancistrocladus congolensis, A. ealaensis,* and *A. likokoi,* the specimen with a typewritten label and a dated annotation by Léonard is here considered the holotype.

Ancistrocladus tectorius (Loureiro) Merrill, Lingnan Sci. J. 6: 329. 1930. *Bembix tectoria* Loureiro, Fl. cochinch. 282. 1790. TYPE: Vietnam, *Loureiro s.n.* (holotype, BM).

I have examined the specimen identified by Moore (1927) as the holotype of *Bembix tectoria* and find no reason to dispute his conclusion.

Ancistrocladus thwaitesii Tieghem, J. Bot. (Morot) 17: 154. 1903. TYPE: Sri Lanka, *Thwaites 1600* (holotype, P; isotypes, BM, BR, GH, HAKS, K, L, SING, US).

At P there are three specimens labeled *Thwaites 1600*. Only one specimen has a label printed "CEYLAN. M. Thwaites, 1854. No." followed by a handwritten "1600"; this specimen is here considered the holotype. Harriman (1987) considered *Ancistrocladus thwaitesii* a taxonomic synonym of *A. hamatus*.

Ancistrocladus uncinatus Hutchinson & Dalziel, Fl. W. trop. Afr., ed. 1, 1: 196. 1927. TYPE: Nigeria. Eket, *Talbot 3108* (holotype, K; isotype, BM).

Ancistrocladus wallichii Planchon, Ann. Sci. Nat. Bot., Sér. 3, 13: 319. 1849. TYPE: "Pundua," *F. de Sylva s.n.* [Wallich, Numer. List 1052.2. 1829] (holotype, K; isotypes, C, GH, K-WALL).

The specimen in K-WALL bearing microfiche number 1052.2 is otherwise labeled "*A. extensus*, Wall. Is this the same precisely as this type from Amherst?". The specimen in K has an inflorescence structure virtually identical to that of the K-WALL specimen and has similarly immature fruits. It is labeled "*Ancistrocladus extensus* Wall, Amherst Wallich 1829, H. I. 1052," and is stamped "HERBARIUM BENTHAMIANUM 1854." The label of the isotype of *A. wallichii* at GH bears a partial marking "BENTHAMIANUM" with what appears to be the lower half of the same stamp. From the above evidence I conclude that the specimen in K represents Wallich's number 1052.2 and is the holotype of *A. wallichii*.

Excluded Names

Ancistrocladus pentagynus Warburg, Bot. Jahrb. Syst. 13: 383. 1891. TYPE: not designated.

Van Steenis (1948) cited Hallier (1923: 77) in considering this a species of *Durandea* Planchon (Linaceae).

Ancistrocladus sagittatus Wallich ex Planchon; Ann. Sci. Nat. Bot., Sér. 3, 13: 319. 1849. TYPE: Singapore [Wallich, Numer. List 1055. 1829].

Van Steenis (1948) placed this name in synonymy with *Tetramerista glabra* Miquel (Tetrameristaceae).

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Wallich, N. 1828–1849. A numerical list of dried specimens of plants in the East India Company Museum, collected under the superintendence of Dr. Wallich of the Company's Botanic Garden at Calcutta. Lithographed manuscript, London.

A New Species of *Jungia* (Compositae) from Bolivia

Gunnar Harling
Department of Systematic Botany, University of Göteborg, Carl Skottsbergs Gata 22B, S-413 19 Göteborg, Sweden

ABSTRACT. A new species of *Jungia*, *J. beckii*, from the Andes of northwestern Bolivia is described and illustrated, and its affinities are briefly discussed.

A short time after the publication of my monograph on the genus *Jungia* (Harling, 1995) I received for determination from Stephan Beck, Herbario Nacional de Bolivia, La Paz, some recent *Jungia* collections from Bolivia. Three of them turned out to belong to a distinct new species, which is described below.

Jungia beckii Harling, sp. nov. TYPE: Bolivia. La Paz: Prov. Nor Yungas, ca. 4 km from Chuspipata towards Puente Villa, downhill towards Río Unduavi, 2900 m, 3 Nov. 1990, *Beck 18672* (holotype, LPB; isotypes, GB, LPB). Figure 1.

Frutex volubilis usque ad 8 m longus, ramis teretibus, striatis, ferrugineo-tomentosis, glabrescentibus. Folia exstipulata, petiolata, laminis chartaceis, ambitu cordato-suborbicularibus, sinu basali profundo angustoque, (8–) 10–16 cm longis, (9–)12–18 cm latis, 7–9-lobatis, lobis obtusis vel rotundatis, margine integris vel crenatis, supra hirtellis vel substrigosis, subtus dense villoso-arachnoideis; petiolus usque ad 9 cm longus, dense ferrugineo-tomentosus. Synflorescentia paniculata, usque ad 70 cm longa, 30 cm lata. Capitula in glomerulis plusminusve laxis, sessilia vel breviter pedunculata; involucrum anguste campanulatum, 5–7 mm latum, phyllariis 10–12, subobblongis, apice late triangularibus, mucronatis, 4.6–5.3 mm longis, 1.2–1.8 mm latis, dorsaliter dense ferrugineo-tomentosis. Flores 16–18, corolla nivea, tubo 3.2–3.5 mm longo, labio exteriore tridentato, 3.2–4.0 mm longo, plusminusve recurvato, labio interiore profunde bipartito, 2.0–2.6(–3.0) mm longo, segmentis convolutis. Achenium (immaturum) subcylindricum, apice truncatum, erostratum, ca. 2 mm longum, leviter puberulum vel haud saepe glabrum, pappi setis fulvis, 7–8 mm longis, minute barbellatis.

Frutescent liana climbing on tree trunks up to ca. 8 m (or perhaps more) with the aid of branches and small adventitious anchoring roots, stems and branches terete to slightly angular, fluted, when young densely brown-tomentose, becoming ± glabrescent, eglandular like the rest of the plant. Leaves exstipulate; lamina chartaceous, suborbicular-cordate in outline, (8–)10–16 cm long, (9–)12–18 cm wide, basal sinus deep and rather narrow, shallowly 7–9-lobed, lobes rounded to obtuse, seldom slightly acute, margin entire to crenate, moderately hirtellous to substrigose above, densely brown-villous to arachnoid beneath, veinlet reticulum beneath ± dark without thickenings; petiole up to 9 cm long, slightly sheathing at base, densely brown-tomentose. Synflorescence a terminal or axillary panicle, up to ca. 70 cm long and ca. 30 cm wide, the branches ending in ± widely spaced glomerules of capitula; lower bracts similar to ordinary leaves but smaller, upper bracts linear to narrowly lanceolate, 3–8 mm long, brown-tomentose. Capitula sessile or on peduncles 1–6 mm long; involucre narrowly campanulate, 5–7 mm wide; accessory bracts 3–5, oblong to lanceolate, 0.8–2.3 mm long, 0.2–0.5 mm wide, densely brown-tomentose; phyllaries 10–12, suboblong, slightly widening upward, apically broadly triangular, mucronate, 4.6–5.3 mm long, 1.2–1.8 mm wide apically, densely brown-tomentose dorsally; paleas coarse, similar to phyllaries but with the pubescence somewhat thinner. Florets 16–18, corolla white, glabrous or with a few hairs, tube gradually widening upward, 3.2–3.5 mm long, outer lip tridentate, 3.2–4.0 mm long, inner lip deeply bifid, 2.0–2.6(–3.0) mm long, both lips ± recurved to coiled, apical appendages of anthers pale violet. Achenes (immature) subcylindric, apically truncate and erostrate, slightly ribbed, ca. 2 mm long, usually slightly pubescent with slender hairs, occasionally glabrous; pappus tawny, 7–8 mm long, bristles minutely barbellate.

This new species belongs to section *Jungia* and appears most closely related to *Jungia ferruginea* L. f. and *J. weberbaueri* Cerrate. The main differences between these species are elucidated in the following key:

1a. Leaves exstipulate, laminas suborbicular in outline, distinctly lobed; corolla white.
  2a. Laminas 5–7-lobed, basal sinus broad and shallow; synflorescence with dense glomerules of heads; florets 8–12; achenes glabrous, pappus bristles plumose; Mexico to southern Colombia . . . . . *J. ferruginea*
  2b. Laminas 7–9(–11)-lobed, basal sinus narrow and deep; synflorescence widely spaced; flo-

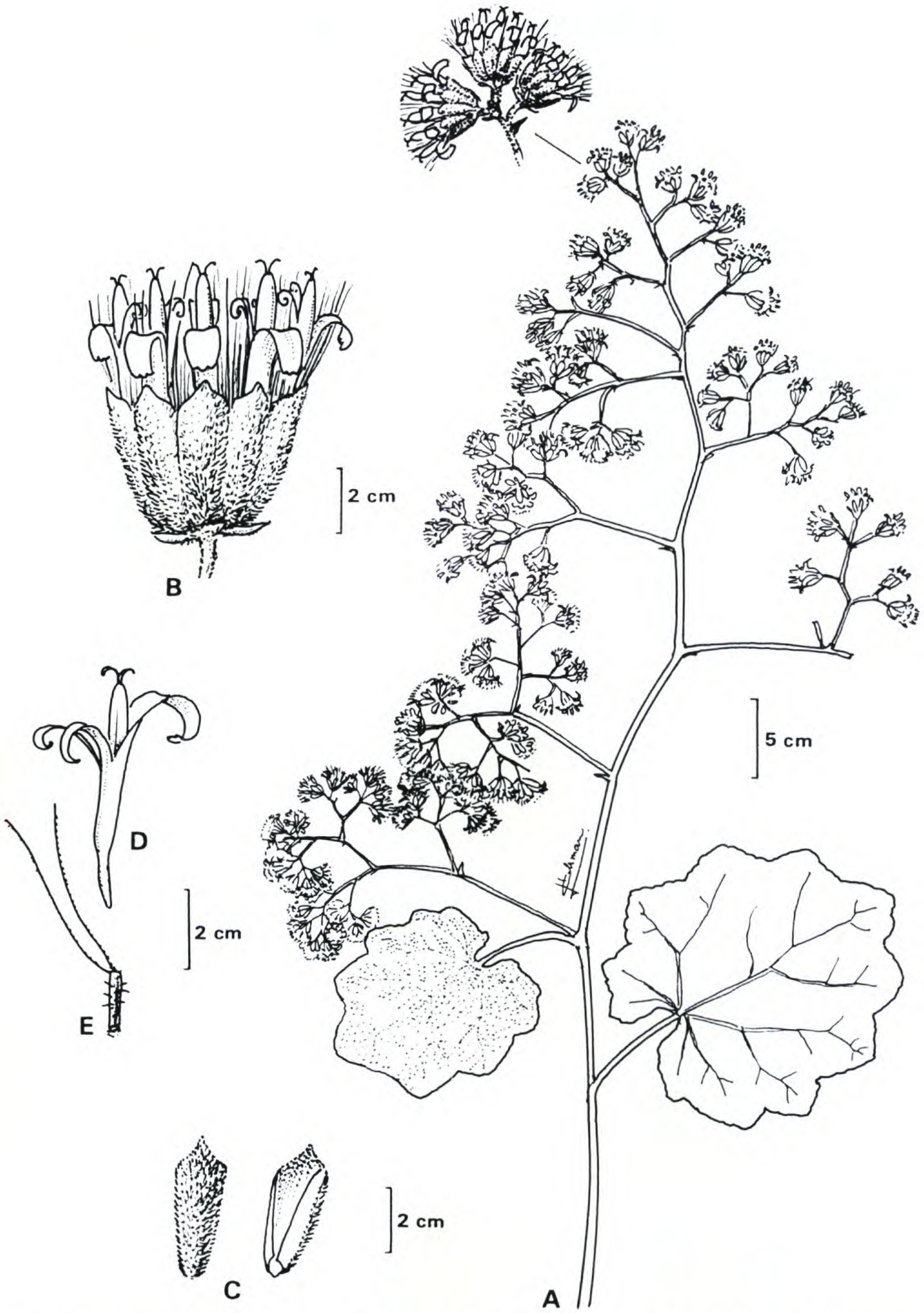

Figure 1. *Jungia beckii* Harling (*Beck 18672*, LPB). —A. Flowering branch. —B. Capitulum. —C. Phyllaries. —D. Flower. —E. Achene, only two pappus bristles shown.

rets 16–18; achenes usually pubescent, pappus bristles minutely barbellate; Bolivia . . . . . *J. beckii*

1b. Leaves usually stipulate, laminas ovate to triangular-ovate in outline, unlobed or very slightly lobed; corolla reddish lilac; southern Ecuador to Bolivia . . . . . *J. weberbaueri*

Jungia beckii is so far known only from the re-

gion around Chuspipata in the Andes of northwestern Bolivia. It grows in high-montane wet forest at about 2800–3000 m elevation. The most common trees (up to ca. 16 m tall) are members of *Weinmannia*, Melastomataceae, and Myrsinaceae (S. Beck, pers. comm.).

Paratypes. BOLIVIA. **La Paz:** Prov. Nor Yungas, 2 km S of Chuspipata, near the abandoned railroad, 3000 m, 24 July 1988, *Beck 13859* (GB, LPB); Chuspipata, descending ca. 2.5 km towards Sud Yungas, 16°18′S, 67°49′W, 2800 m, 22 Jan. 1995, *Beck 21737* (GB, LPB).

Acknowledgments. I thank Uno Eliasson and Jim Solomon for critical reading of the manuscript, and Liselotte Öhman for the drawing.

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Harling, G. 1995. The genus *Jungia* L. fil. (Compositae–Mutisieae). Acta Regiae Soc. Sci. Litt. Gothob., Bot. 4: 1–133.

Blotia leandriana (Euphorbiaceae–Phyllanthoideae), a New Species from Eastern Madagascar

Petra Hoffmann
Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AB, England

Gordon McPherson
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

ABSTRACT. *Blotia leandriana*, endemic to the eastern coastal forests of Madagascar, is described and contrasted with its congeners. It is most similar to *B. oblongifolia* (Baillon) Leandri but is distinguished by its smaller leaves and fruits, its inconspicuous secondary venation, and its shorter, unchanneled petioles.

Blotia leandriana Petra Hoffmann & McPherson, sp. nov. TYPE: Madagascar. Toliara, Tolanaro (Fort Dauphin), NE of town in coastal forest called Mandena, roadside forest E of and beyond QIT camp, 25 m, 7 Dec. 1989, *G. McPherson & N. Dumetz 14651* (holotype, MO; isotypes, B, DAV, K, P, TAN, TEF). Figure 1.

Species *Blotiae* characterum combinatione ab aliis speciebus generis distinguenda: a *B. bemarensi* Leandri foliis ellipticis nunquam ovatis, petalis distincte unguiculatis; a *B. hildebrandtii* (Baillon) Leandri foliis maioribus, petalis sepalis aequilongis, pedicellis florigeris et fructigeris longioribus; a *B. oblongifolia* (Baillon) Leandri foliis fructibusque minoribus, petiolis brevioribus teretibus non canaliculatis, venis secundariis in sicco tam prominentibus quam venibus tenuioribus; a *B. tanalorum* Leandri foliis plerumque coriaceis, floribus minoribus, apicibus sepalorum non incrassatis, petalis distincte unguiculatis differt.

Monoecious shrubs or small trees up to 8 m. Young twigs terete, glabrous, minutely puberulent or sparsely pubescent, glossy. Stipules linear, acute, 3–4 mm long, 0.5–1 mm wide, glabrous, very thin, red to black when dried, usually persistent. Petiole flat adaxially to terete, not canaliculate, 1–3 mm long, 0.7–1 mm wide, glabrous or more rarely puberulent. Leaf blades elliptic, (2–)3–6(–8) cm long, 1–3 cm wide; apex usually acuminate to an obtuse or broadly acute tip, sometimes obtuse; base acute to narrowly obtuse, not or only obscurely auriculate; margin plane to slightly revolute; glabrous, coriaceous or rarely chartaceous, light grayish green when dried, dull, the midvein prominent on both sides, secondaries 7–12 pairs below the acumen, not conspicuous compared with finer venation, which is more prominent abaxially than adaxially. Inflorescences axillary (but reported also to be cauline), staminate and pistillate flowers together in fascicles of 5–20 borne directly in the leaf axils or on unbranched, usually leafless axes up to 1 cm long. Flowers ca. 2 mm long, 2–3 mm wide, pedicellate, bracteate; the pedicels terete, glabrous; the bracts 3 per flower, deltoid, acute, ca. 0.5 mm long, ca. 0.5 mm wide, glabrous except for ciliate margins. Buds globose. Staminate flowers on pedicels 10–15 mm long, ca. 0.2 mm wide. Sepals 5, oblong to obovate, apex rounded, not thickened, 1.5–2 mm long, 1–1.2 mm wide, entire, glabrous or sparsely pubescent on margins, coriaceous. Petals 5, spathulate, rounded, 1.2–1.5 mm long, 0.7–1 mm wide, extending to the same level as the sepals, often reflexed, distinctly clawed, erose. Disc episepalously lobed, lobes separate or connate at the base, 0.2–0.3 mm long, thick, glabrous. Stamens 5, ca. 1 mm long, fused at the base for ⅓ to ½ of their length, their free parts erect. Pistillode clavate to cylindrical, ca. 0.5 mm long, 0.2–0.3 mm wide, apex 3-lobed, lobes erect, terete to almost semiglobose, sometimes channeled inside, glabrous. Pistillate flowers on pedicels 10–20 mm long, ca. 0.3 mm wide. Sepals 5, oblong to obovate, apex rounded, not thickened, ca. 1.5 mm long, 1–1.5 mm wide, entire, glabrous or sparsely pubescent on margins. Petals 5, spathulate, rounded, 1–1.2 mm long, 0.7–1 mm wide, slightly shorter than the sepals, often reflexed, distinctly clawed, erose. Disc annular, episepalously lobed, margin erose, ca. 0.2 mm long, glabrous, thick. Ovary globose, ca. 1 mm long, glabrous. Styles 3, 2-fid to the base, their branches terete, ca. 0.3 mm long, ca. 0.1 mm wide, spreading, glabrous. Stigmas acute to truncate. Fruits solitary or in pairs, subglobose, shallowly 3-lobed, 6–9 mm long, 6–11 mm wide, glabrous, reticulate because of the prominent venation, light brown. Fruiting pedicels 10–25 mm long, 0.3–0.5 mm wide, glabrous. Columella 5–7 mm long, base and apex ca. 1 mm wide, thinner in the middle.

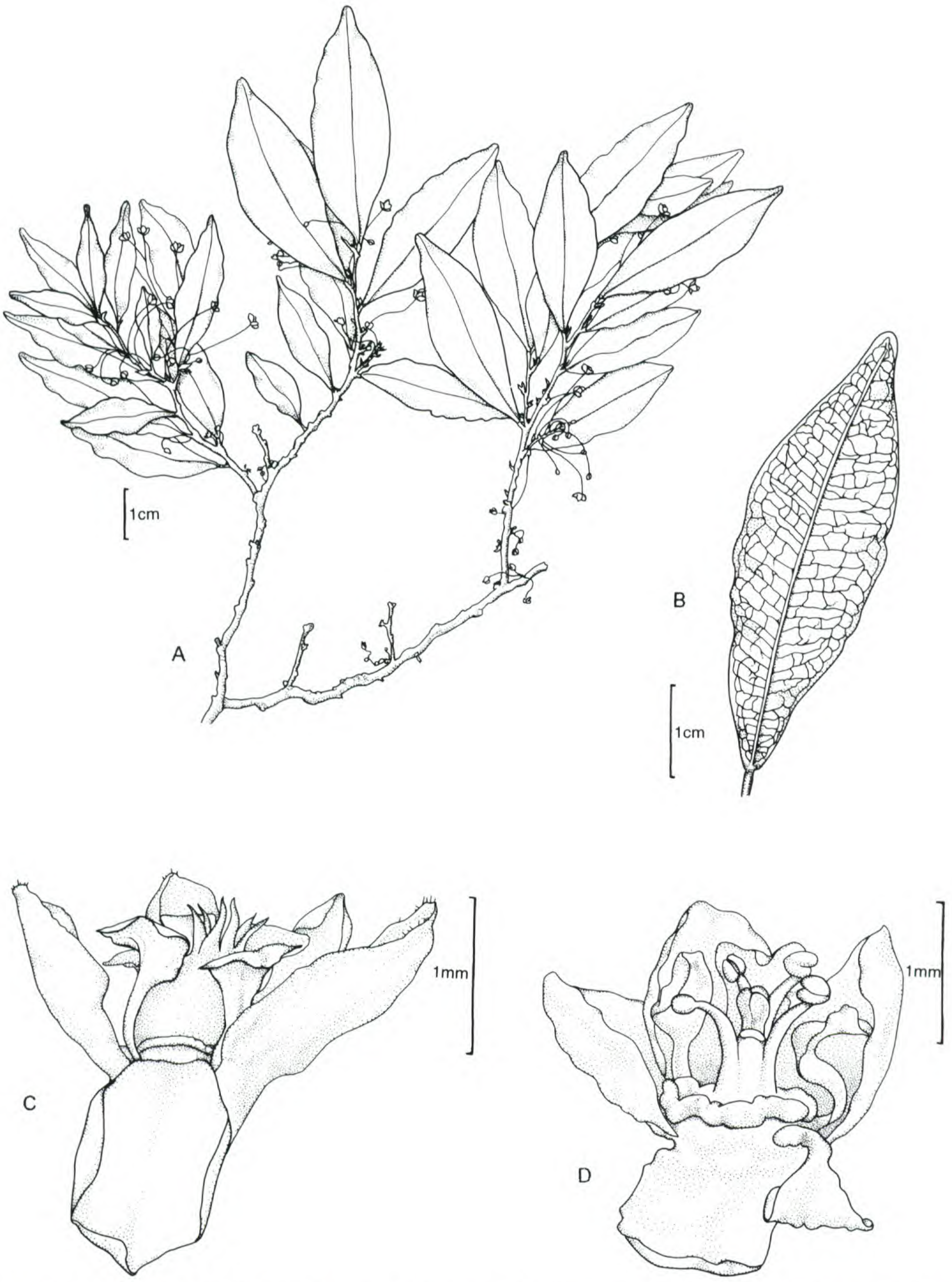

Figure 1. *Blotia leandriana* Petra Hoffmann & McPherson. —A. Habit. —B. Leaf. —C. Pistillate flower. —D. Staminate flower with one sepal, one petal, and part of one stamen removed.

Exocarp ca. 0.2 mm thick. Endocarp ca. 0.4 mm thick. Seeds 1–2 per locule, 5–7 mm long, 4–5 mm (1-seeded locules) or ca. 3 mm (2-seeded locules) wide, smooth, slightly shiny, light brown.

Distribution and ecology. East coast of Madagascar, between Vohimarina (Vohémar) and Tolanaro (Fort Dauphin), in coastal forest, usually on sand, at 10–150 m elevation.

Key characters. Petioles not channeled, leaves elliptic, 3–6 cm long, 1–3 cm wide, secondary veins about as prominent as finer venation, apices of sepals not thickened, petals distinctly clawed, extending to the same level as the sepals, fruiting pedicels up to 25 mm long, fruits not exceeding 9 × 11 mm in size.

The new species differs from *Blotia bemarensis* in having elliptic, never ovate, leaves and distinctly clawed petals; from *B. hildebrandtii* in having larger leaves, petals extending to the same level as the sepals, and longer flowering and fruiting pedicels; from *B. oblongifolia* in having smaller leaves and fruits, unchanneled petioles, and secondary veins scarcely more conspicuous than the finer venation; and from *B. tanalorum* in having mostly coriaceous leaves, smaller flowers, unthickened sepal apices, and distinctly clawed petals.

Paratypes. MADAGASCAR. 32 km au sud de Vohémar, à l'ouest de la route, 50–150 m, forêt, 26 Sep. 1988, *Badré 2074* (P); Fort Dauphin, Mandena Campement, 7 Dec. 1989, *Dumetz & McPherson 1136* (MO, P, TAN, TEF); Tolanaro (Fort Dauphin) region, ca. 117 km N of city, ca. 7 km N of Manantenina, forest remnant called Analalava, 8 Nov. 1989, *McPherson 14407* (MO, P, TAN, TEF); N of Fort Dauphin (Tolanaro), Ste. Luce region, Manofiafy, 25 m, 19 Oct. 1989, *McPherson (et al.) 14158, 14170* (MO, P, TAN, TEF); Tolanaro (Fort Dauphin), Mandena (QIT-Fer), parcelle 4, 18 Apr. 1989, *Rabevohitra 1898* (MO, P, TAN, TEF); Tolanaro (Fort Dauphin), Mandena, 10 m, 13 Jan. 1990, *Rabevohitra 2125* (K, MO, P, TAN, TEF); Mandena, *Rajeriarison Euph 34* (P); Tamatave, Réserve Naturelle 1, 27 July 1950, *Rakotoniaina 2632-RN* (P); Farafangana, J.B. No. 16, Manombo, Canton Ihorombé, *Service des Eaux et Forêts 16270-SF* (P).

Acknowledgments. We are indebted to the curators of K, MO, and P for providing the opportunity to study their collections. Thanks are also due to Alan Radcliffe-Smith for checking the Latin diagnosis and to Barbara Alongi and Mark Olson for drawing the illustration.

Pollia macrobracteata Hong, a New Species of Commelinaceae from China

Hong De-yuan

Laboratory of Systematic and Evolutionary Botany, Institute of Botany, Chinese Academy of Sciences, 20 Nanxincun, Xiangshan, Beijing 100093, China

ABSTRACT. *Pollia macrobracteata*, a new species from Guangxi (China), is described, and its relationship and distinguishing characters are discussed.

During my 1994 visit to the Missouri Botanical Garden to study Chinese plants of various families, the following new species was discovered. The species is herein described to make the name available for the forthcoming volume 24 of the *Flora of China.*

Pollia macrobracteata Hong, sp. nov. TYPE: China. Guangxi: Longzhou, Daqing Shan, jungle at mountain summit, 30 May 1935, *S. P. Ko 55196* (holotype, IBSC; isotype, MO).

Polliae japonicae Thunberg et *P. hasskarlii* R. S. Rao affinis, sed ab eis foliis multo minoribus atque vaginis foliaribus brevioribus differt; ab illa pedunculis inflorescentiisque multo brevioribus atque bracteis ovatis majoribus apice late acutis differt; a hac bracteis herbaceis majoribus, cincinnorum pedunculis pedicellisque longioribus atque radicibus caulinis multo gracilioribus differt.

Herbs perennial, more than 35 cm tall. Stems ascending, unbranched; lower part ca. 5 mm diam. when dry, glabrous, lower node with roots ca. 0.5 mm diam.; internodes 4–4.5 cm long. Sheaths ca. 6 mm long, sparsely puberulent on the side opposite the leaf blade, glabrous elsewhere; lamina sessile, elliptic, 7–12.5 cm long, ca. 3 cm wide, glabrous on both surfaces, apex cuspidate; uppermost leaves smaller, lanceolate, ca. 3 cm long, ca. 0.9 cm wide, apex acuminate. Inflorescences (excluding peduncle) 8–12 cm long, ca. 4 cm wide, hooked hairy on axes; peduncle ca. 4.9 cm long; cincinnus bracts herbaceous, ovate, ca. 13 cm long, ca. 7.5 mm wide, apex broadly acute, upper ones slightly smaller; cincinni whorled or nearly so, whorls 6, each with 2–4 cincinni; cincinni 3- or 4(or more)-flowered, with peduncles 7–9 mm long; bracteoles membranous, glabrous, ca. 2 mm long, very wide and almost entirely clasping cincinnus axes; pedicel ca. 4 mm. Flowers actinomorphic; sepals 3, ca. 6 mm long, free, hooded, sparsely hooked hairy outside; petals white, purple spotted, narrowly oblong, ca. 6 mm long, ca. 3 mm wide; stamens 6, all fertile, equal; filaments glabrous, ca. 4 mm long; anthers narrowly oblong, locules parallel. Style glabrous, ca. 4.5 mm long; stigma capitate. Fruit not seen.

Pollia macrobracteata is related to *P. japonica* and *P. hasskarlii*: all three have six fertile stamens and relatively dense inflorescences. However, *P. macrobracteata* is easily distinguished from these by its much smaller leaves and shorter sheaths. From *P. japonica*, it differs in having peduncles ca. 4.9 cm long, inflorescences ca. 12 cm long, sparsely hairy sepals, and cincinnus bracts that are ovate, larger, and broadly acute. In *P. japonica*, the peduncles and inflorescences are much longer, the sepals are glabrous, and the cincinnus bracts are lanceolate and apically acuminate. From *P. hasskarlii*, *P. macrobracteata* is readily distinguished by having larger, herbaceous (instead of membranous) cincinnus bracts, longer cincinnus peduncles and pedicels, and more slender (0.5 vs. 3 mm) roots from the lower stem nodes. Both *P. hasskarlii* and *P. macrobracteata* have undulate petiole/lamina bases, shorter peduncles, large cincinnus bracts, and pubescent sepals.

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Una Nueva Especie del Sur de Mexico, *Marsdenia callosa* (Asclepiadaceae)

Verónica Juárez-Jaimes
Instituto de Biología, UNAM, Apartado Postal 70-233, Del. Coyoacán, 04510 México, D. F., México

W. Douglas Stevens
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

RESUMEN. Se describe e ilustra a *Marsdenia callosa*, una nueva especie de Asclepiadaceae del Sur de México, que por mucho tiempo ha sido confundida con *Marsdenia edulis* S. Watson, la cual presenta una distribución más norteña. La principal característica que distingue a *Marsdenia callosa* de *M. edulis* es la presencia de un callo anular y carnoso con pelos dorados en la garganta de la corola.

ABSTRACT. *Marsdenia callosa*, a new species of Asclepiadaceae from southern Mexico, is described and illustrated. This species resembles *Marsdenia edulis* S. Watson, which has a more northern distribution. The main character that distinguishes *Marsdenia callosa* from *M. edulis* is an annular and fleshy callus with golden hairs in the throat of the corolla.

Marsdenia callosa Juárez-Jaimes & W. D. Stevens, sp. nov. TIPO: México. Guerrero: Municipio Acapulco de Juárez, cerca de la playa El Revolcadero, 16°47′N, 99°49′W, a nivel del mar, manchón de vegetación secundaria posiblemente derivada de un bosque tropical deciduo, sobre sustrato rocoso, jul. 1992, *V. Juárez, M. Ortiz & N. M. Ortiz 620* (holótipo, MEXU; isótipos, FCME, MO). Figura 1.

M. edulis S. Watson similis, sed differt corolla breviter campanulata, carnosa, fauce hirsuto aureo, pilis callo anulari carnoso, in sinibus crassiore, crescentibus.

Enredadera, con látex blanco. Tallos glabros o puberulentos en los nudos, lenticelados cuando jóvenes, suberosos y leñosos cuando maduros. Pecíolos 1.0–1.5 cm, puberulentos; láminas 5–10 × 3.5–6.5 cm, elípticas a ovado-elípticas, con 6 a 7 pares de venas laterales, base generalmente atenuada, ápice acuminado, haz glabro, con 5–7 glándulas en la base, envés puberulento, margen entero a ligeramente ondulado e involuto al secarse. Inflorescencias 1.0 × 1.5 cm, con 10–20 flores, extra-axilares, cimas umbelifomes compactas; pedúnculos 2 mm, puberulentos a glabrescentes con la edad; pedicelos 2–3 mm, densamente puberulentos, brácteas anchamente lanceoladas, puberulentas a glabras. Lóbulos del cáliz, 2.9 × 3.3 mm, orbiculares, puberulentos en el haz, glabros en el envés, cada seno con una glándula en la parte interna; corola 5–7 mm, cortamente campanulada, carnosa, lóbulos 2.5 × 2.8 mm, triangulares, glabros en ambas superficies, ápice a veces con una pequeña emarginación, garganta de la corola con pelos dorados dispuestos en la periferia, creciendo sobre un callo anular carnoso y más grueso en los senos, tubo 2 mm, glabro; ginostegio cónico 2.3 mm (sin el ápice del estilo), lóbulos de la corona estaminal 1.5 × 1.3 mm, sagitados y engrosados con la punta libre terminando por debajo del ápice de las anteras; membranas de las anteras 1.2 mm, oblongo-elípticas, anteras 0.5 mm, oblongas; corpúsculos 0.4 mm, elípticos, polinios 0.5 mm, elipsoides; ápice del estilo 0.4–0.7 mm, cónico-redondeado, carpelos glabros. Folículos elipsoides 8–11 × 4–5 cm, leñosos, verdes, glaucos, glabros; semillas obovadas, con el borde marcado, margen entero, superficie lisa; vilano 5 cm, blanco.

Distribución y hábitat. Se conoce solamente del Sur de México en en los Estados de Jalisco, Guerrero y Michoacán, en áreas cercanas a las costas con clima tropical seco, en bosque tropical deciduo o vegetación derivada de éste, a altitudes menores a los 100 msnm.

Paratipos. MEXICO. **Guerrero:** Mpio. Acapulco de Juárez, Puerto Marqués, 20 mayo 1979, *F. Chiang 723* (MEXU); Mpio. Coyuca de Benítez, 1 km al NW del Carrizal, sobre el canal, Laguna de Mitla, 7 sep. 1985, *L. Lozada 660* (FCME, MEXU); along Hwy. 200 at Km 178, about 1 mi. SE of Cayacal, 1 Aug. 1971, *W. D. Stevens 1367* (MEXU, MO). **Michoacán:** Mpio. Coahuayana, 4 km al SE de San Juan de Lima, por la carretera Tecomán, Playa Azul, *E. Martínez 4512* (MEXU).

Discusión. Se fundamenta la creación de una nueva especie *Marsdenia callosa*, por la presencia

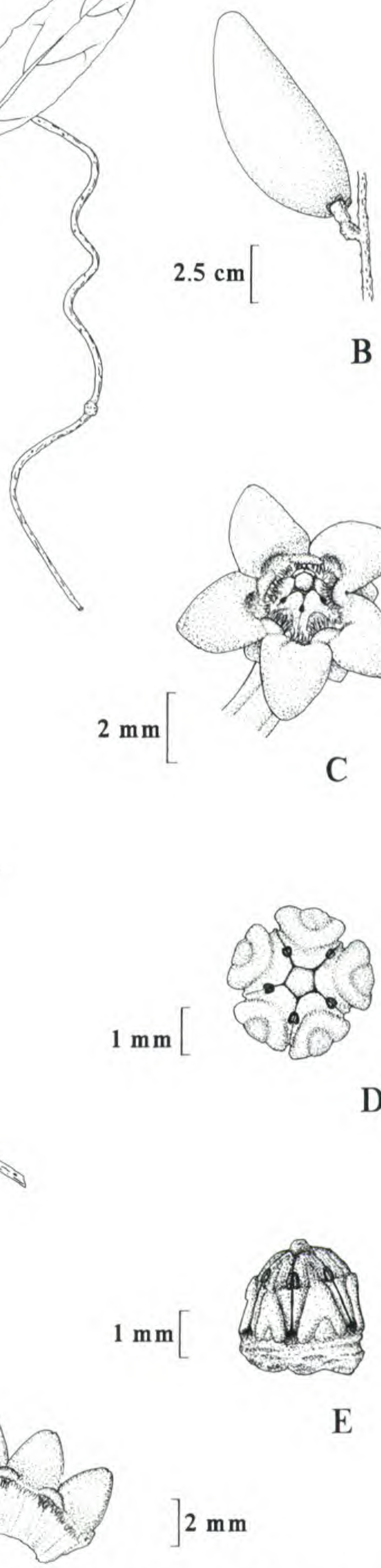

Figura 1. *Marsdenia callosa* Juárez-Jaimes & W. D. Stevens. —A. Rama con hojas y botones. —B. Fruto. —C. Flor mostrando el callo anular en la garganta de la corola. —D. Ginostegio (vista superior). —E. Ginostegio (vista lateral). —F. Vista interior de la corola. —G. Polinario. —H. Semilla. Basado en *V. Juárez, M. Ortiz y N. M. Ortiz 620.*

de una corola de color blanco cremosa, un callo anular engrosado en los senos de la corola, un anillo de pelos dorados en la garganta y un ápice del estilo cónico, así como su distribución hasta el momento restringida a Jalisco, Guerrero y Michoacán. Estas características la hacen diferente a *M. edulis* S. Watson, la cual tiene en el tubo de la corola pelos pardos, ápice del estilo alargado y bífido, y se distribuye en los Estados de Nayarit, Sinaloa y Sonora.

Agradecimientos. A Patricia Dávila, Miguel Ortiz y Fernando Chiang por la revisión del manuscrito. A este último por la diagnosis en latín.

Two New Species of *Diospyros* (Ebenaceae) from Mesoamerica

Sandra Knapp
Department of Botany, The Natural History Museum, Cromwell Road, London, SW7 5BD, United Kingdom

ABSTRACT. *Diospyros hartmanniana*, of cloud forests in Panama and Costa Rica, and *Diospyros whitei*, of lowland forests in central and eastern Panama, are described and illustrated. Their similarities to and differences from other Mesoamerican species of *Diospyros* are discussed.

The genus *Diospyros* consists of approximately 500 species of small to large trees distributed throughout the tropics and subtropics of the world. The last worldwide revision of the family Ebenaceae was that of Hiern (1873), where some 250 species were recognized. Hiern recognized five genera, *Royena* L., *Euclea* Murray, *Maba* J. R. Forster & G. Forster, *Tetraclis* Hiern, and *Diospyros* L. In *Diospyros* s. str., Hiern recognized 14 sections defined on characters of the seed and inflorescence. Only a fraction of the approximately 80 New World taxa were included in Hiern's monograph. Bakhuizen van den Brink (1936), in monographing the Malaysian species of Ebenaceae, placed the genus *Maba* into synonymy with *Diospyros* at the rank of subgenus. He divided the Asian species of *Diospyros* into 36 sections, most of which are probably artificial (White, 1983). *Royena* and *Maba* are currently placed within the genus *Diospyros* s.l. (White, 1983), and Old World species previously regarded as *Maba* are placed in section *Forsteria* (Bakhuizen van den Brink) White. In his treatment of Ebenaceae for *Flora Zambesiaca*, White (1983) recognized 11 sections, most of which were endemic to Africa. Section *Forsteria* has several species in the New World and is defined by its possession of an ovary with three bi-ovulate locules. In Mesoamerica only *D. inconstans* Jacquin and *D. salicifolia* Willdenow are members of this group. For the rest of the taxa occurring in the Neotropics, no sectional classification has been proposed. In Asia, where some 200 species of *Diospyros* occur, the sectional classification proposed by Bakhuizen van den Brink (1936) has not been taken up in floras, and many species have been described relatively recently. In the course of preparing the treatment of *Diospyros* for *Flora Mesoamericana* the following new taxa were encountered.

Diospyros hartmanniana S. Knapp, sp. nov. TYPE: Panama. Chiriquí: near Costa Rican border, ca. 13 road-km from Río Sereno, Finca Hartmann, 1550–1750 m, 8°50′N, 82°45′W, 23 Oct. 1992, *G. McPherson & P. M. Richardson 15959* (holotype, BM; isotypes, MO, PMA not seen). Figure 1.

Species haec a *Diospyros campechiana* Lundell, foliis coriaceis petiolo breviori (6–9 mm longo vs. 10–20 mm longo), inflorescentia masculina tantum 3–5-flora, inflorescentia feminei uniflora, floribus carnosis, staminibus filamentis aureo-pubescentibus, baccis globosis, differt.

Trees, 6–20 m; branchlets glabrous or minutely strigose with scattered black trichomes, drying shiny black, the buds coarsely and densely black-strigose. Leaves 6–11 × 3–5 cm, elliptic, thick and coriaceous, glabrous above, sparsely strigose with scattered coarse black trichomes beneath, the trichomes denser near the veins, glabrescent, the young leaves densely black-strigose beneath, the trichomes breaking off and leaving black dots on the leaf undersides, the base acute, the margins somewhat revolute, the apex broadly acute, the ultimate tip rounded; lateral nerves 5–6 pairs, inconspicuous, the midvein drying darker beneath; petiole 6–9 mm, fleshy. Inflorescences axillary along the current growth. Male flowers in 3–4(–5)-flowered subsessile to shortly pedunculate cymules, the peduncle and bracts black-strigose, the pedicels ca. 0.5 mm; calyx 1.5–2 mm, fleshy, black-strigose without, glabrous within, drying black, the tube ca. 1 mm, flat, the lobes 5, ca. 1.5 mm, semiorbicular; corolla 4–5 mm, urceolate to somewhat salverform, glabrous throughout, drying black, the tube 3–3.5 mm, the lobes 4, ca. 1.5 mm, broadly deltate, the margins thinner and overlapping in bud; stamens ca. 10–12(–20), 1.5–2 mm (not including the elongate connective), densely golden pubescent, the connective long-apiculate; pistillode ca. 1 mm, black-strigose at the apex, otherwise glabrous. Female flowers (seen in young fruit only) solitary, sessile or nearly so, the pedicel 0–0.5 mm. Fruits 1.5–2.5 cm diam., yellow-orange when ripe, drying reddish brown, glabrous except for a patch of stiff black trichomes around the persistent style base;

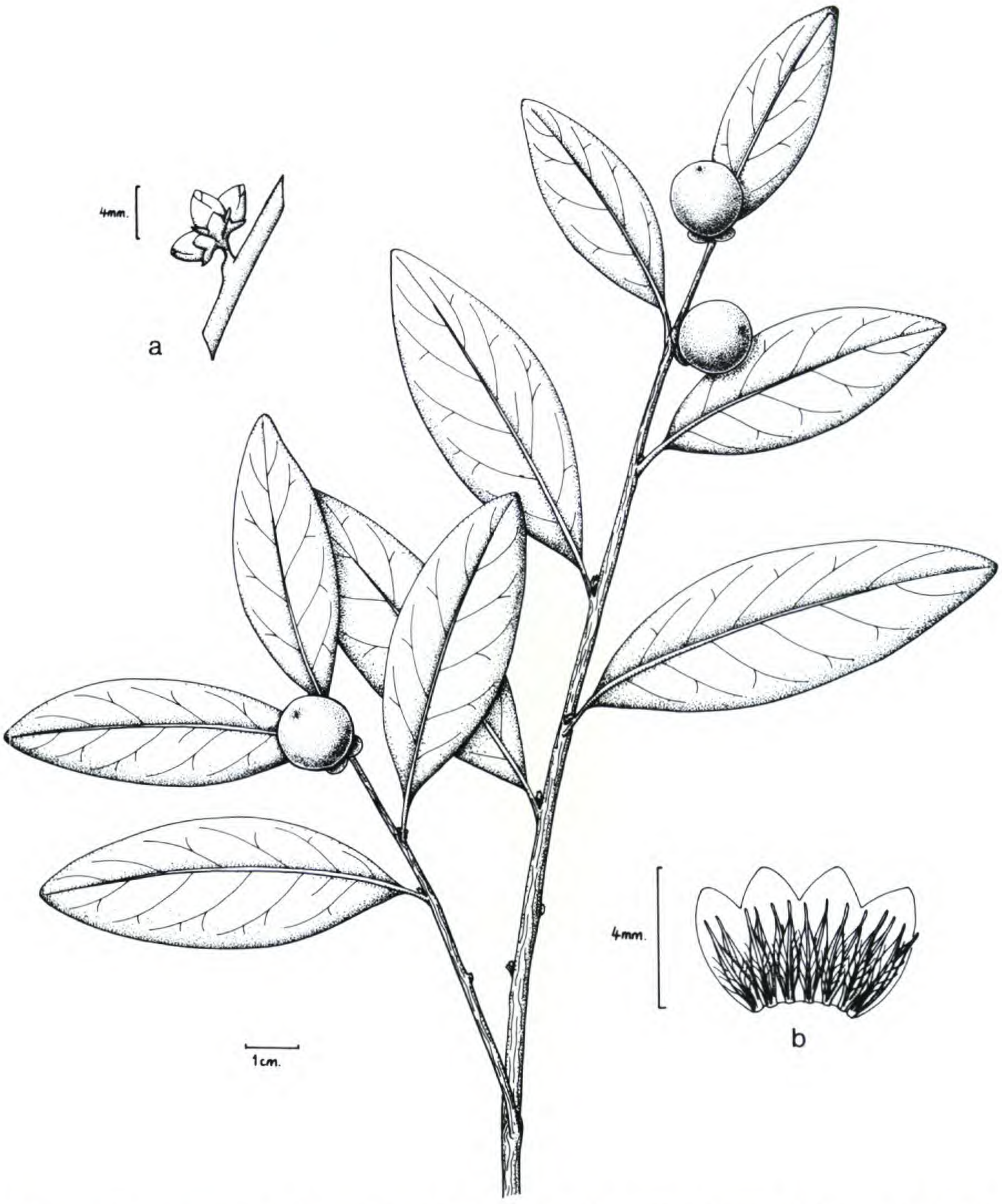

Figure 1. *Diospyros hartmanniana* S. Knapp (from *McPherson & Richardson 15959*, BM). —a. Male inflorescence of *D. hartmanniana* (from *McPherson & Hensold 15303*, MO). —b. Detail of male flower (from *McPherson & Hensold 15303*, MO).

locules 4 (?); fruiting pedicel ca. 0.5 mm, the fruits essentially sessile; fruiting calyx 0.8–1.2 cm diam., saucer-shaped, fleshy (?), lobed ca. to the middle, the lobes 4, 2.5–3 mm, wider than long, semi-orbicular, sparsely black-strigose, glabrescent, the apex rounded to flat. Seeds 4 or fewer by abortion, ca. 1 × 0.5 cm, dark brown.

Etymology. This species is named in honor of Ratibor Hartmann, on whose finca the type was collected and who has been a kind and generous host to many plant collectors in Panama.

Distribution. Cloud forests in extreme western Panama and in the Cordillera de Tilarán, Costa Rica; 1400–2200 m. Figure 2.

Diospyros hartmanniana is easy to distinguish from all other Mesoamerican *Diospyros* by its copious, coarse, black-strigose pubescence on the buds and new leaves. This type of pubescence is also found to some degree in *D. campechiana* Lundell of Guatemala and adjacent Mexico, but in that species the pubescence itself is less dense, and the trichomes are more slender and fine. These black trichomes break off in older leaves, leaving a circular base that looks somewhat like the black glands found in the genus *Hypericum.* Fruits of *D. campechiana* are more ellipsoid in shape than those of *D. hartmanniana*, and the leaves are in general larger (most commonly 15–26 × 5–9 cm) and dry a rich golden brown. The flowers of *D. hartmanniana* all dry black, and like the flowers of *D. di-*

Figure 2. Distribution of *D. hartmanniana* (circles) and *D. whitei* (squares).

gyna Jacquin, which dry similarly, are probably quite fleshy on live plants. None of the specimens mention this detail, so future collectors of this species are urged to record this information.

Paratypes. COSTA RICA. **Guanacaste:** Monteverde, transect 8, 1550 m, 10°48′N, 84°59′W, 13 July 1990, *A. Gentry et al. 71605* (BM, MO). PANAMA. **Chiriquí:** Cerro Pando area, ca. 2200 m, 8°52′N, 82°43′W, 24 Aug. 1982, *Hamilton et al. 969* (BM, MO); near border with Costa Rica, ca. 13 road-km from Río Sereno, Finca Hartmann, 1400–1800 m, 12 May 1991, *G. McPherson & N. Hensold 15303* (BM, FHO, MO), *G. McPherson & N. Hensold 15310* (BM, MO).

Diospyros whitei S. Knapp, sp. nov. TYPE: Panama. San Blas: Río Diablo y vecindad de Duque Sui, a unos 10 km de la costa frente a la Isla de Nargana, ruta hacia Cerro Ibedón, 80–110 m, 9°22′N, 78°35′W, *H. Herrera et al. 1175* (holotype, BM; isotypes, MO, PMA not seen). Figure 3.

Species haec a *Diospyros campechiana* Lundell, caule aureo-pubescente, foliis venatione scalariforme, lobis calycis intus dense aureo-adpresso-pubescentibus, baccis (immaturis?) minoribus, globosis, ad apicem aureo-pubescentibus, differt.

Tree to ca. 5 m; branchlets irregularly compressed, channeled when dry, dark brown, sparsely and minutely golden pubescent, the trichomes appressed. Leaves 9–20 × 3.5–8 cm, elliptic, chartaceous, drying dark, reddish brown; both surfaces glabrous except for a few minute golden, appressed hairs beneath, the base acute to slightly rounded, somewhat asymmetrical, the margins plane, the apex briefly subacuminate; lateral nerves in 6–8 pairs, raised beneath, the tertiary nerves subscalariform. Inflorescences axillary. Male flowers unknown. Female flowers in axillary 2–3-flowered fascicles, otherwise unknown, the pedicels (in fruit) ca. 2 mm. Fruit ca. 1.5 cm diam., subglobose, glabrescent with patches of persistent, long, golden, tightly appressed and silky hairs; styles 5, 1–1.5 mm, fused at the base, persistent on immature fruit, the stigmas irregularly lobed; fruiting pedicel ca. 2 mm, stout and woody; fruiting calyx 6–8 mm diam., saucer-shaped, shallowly 4-lobed, the lobes 1–2 mm, semiorbicular, strigillose on both surfaces, more densely so adaxially, the margins thickened and slightly reflexed. Mature fruits and seeds not known.

Figure 3. *Diospyros whitei* S. Knapp (from *Herrera et al. 1175*, MO).

Etymology. This species is named in honor of the late Frank White (1927–1994), a life-long student of the family Ebenaceae.

Distribution. Central and eastern Panama in lowland to middle elevation rainforest, 80–800 m. Figure 2.

This species was first described by the late Frank White in the *Flora of Panama*, as sp. I (1978). It is still known only from immature fruiting material, but is quite clearly different from any other Mesoamerican or northern South American species of the genus. White (1978) felt that *D. whitei* was perhaps related to *D. campechiana*, but its golden, rather than black, pubescence and densely appressed-pubescent calyx lobes in fruit distinguish it from that species. The ladder-like venation in mature leaves (see Fig. 3) is distinctive, and not found in any other Mesoamerican species of *Diospyros*. The essentially glabrous leaves with only a few trichomes along the midrib are also found in *D. digyna*. That species is easily distinguished from *D. whitei*, however, by its leathery leaves with indistinct venation, solitary female flowers, and large green fruit with a leathery pericarp. The fruits on the specimens examined by both White and ourselves are probably not mature, thus the dense pubescence at the apex may be sparser or absent in more mature specimens. More collections of this species, particularly of male plants, are urgently needed.

Paratypes. PANAMA. **Coclé:** new works at Rivera

sawmill, Alto Calvario, 600–800 m, 12 May 1977, *Folsom 3168* (MO). **Darién:** Cerro Pirre, 4 Aug. 1967, *Bristan 1229* (MO, NY cited by White (1978), not seen).

Acknowledgments. I thank Amy Pool (MO), Mike Gilbert (MO, BM), and Nancy Garwood for helpful discussions; Carol Merryman for the illustrations; N. K. B. Robson (BM) for much help with the Latin diagnoses; and the curators of the herbaria listed in the text for loan of specimens.

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Note added in proof

The following specimens of *Diospyros hartmanniana* were seen by the author after this paper went to press (duplicates of these collections are most probably at MO and INB):

COSTA RICA. **Alajuela:** Reserva Biológica Monteverde, Estación Eladios, 820 m, 10°19′N, 84°43′W, 2 Oct. 1990, *Bello 2442* (FHO). **Guanacaste:** Canton de Tilarán, Río Cañas, lado pacifico, 10°20′N, 84°51′W, 25 Aug. 1989, *Bello 1124* (FHO). **Puntarenas:** Monteverde, Fina Pablo Morales, 1600 m, 10°15′N, 84°48′W, 11 Jan. 1990, *Bello 1767* (FHO); Monteverde, cliff edge above Quebrada Maquina, along Río Fonseca, 1100–1300 m, 10°18′N, 84°48′W, 3 Jan. 1990, *Haber & Daniel 9895* (FHO); Monteverde, Bajo Tigre reserve, Pacific slope, 1200–1300 m, 10°18′N, 84°48′W, 3 Apr. 1990, *Haber & Zuchowski 10600* (FHO); Monteverde, Valle del Río Peñas Blancas, Fila del Toro, sendero Pipilacha y Campo Tres, 900–1100 m, 10°N, 84°W, 21 Jan. 1991, *Haber & Cruz 10632* (FHO); Canton Buenos Olán, upper reaches of Río Cabagra, 1700 m, 9°17′40″N, 83°11′50″W, 24 Sep. 1989, *Herrera 3542* (FHO).

Notes on Gymnosperms I. Taxonomic Treatments of Some Chinese Conifers

Li Nan

Herbarium, Shenzhen Fairy Lake Botanical Garden, Liantang, Shenzhen, Guangdong 518004, People's Republic of China

Fu Li-kuo

Institute of Botany, Chinese Academy of Sciences, 20 Nanxincun, Xiangshan, Beijing 100093, People's Republic of China

ABSTRACT. A new species, *Taxus fuana* Nan Li & R. R. Mill, and two new varieties, *Abies ferreana* Bordères & Gaussen var. *longibracteata* L. K. Fu & Nan Li and *Pinus kwangtungensis* Chun ex Tsiang var. *varifolia* Nan Li & Y. C. Zhong, are described. Thirteen new combinations are proposed in the genera *Abies, Keteleeria, Larix, Picea, Pinus, Pseudotsuga, Tsuga, Cephalotaxus,* and *Taxus.*

During the revision of gymnosperms for the *Flora of China,* and as a result of the examination of types and other specimens in some of the major herbaria in Europe and the United States, the following taxonomic novelties are proposed.

Abies ferreana Bordères & Gaussen var. **longibracteata** L. K. Fu & Nan Li, var. nov. TYPE: China. NW Yunnan: high mountainous belts, ca. 3950 m, *Zhongdian Expedition 1980* (holotype, PE).

A var. *ferreana* recedit strobilorum bracteis exsertis, non recurvatis, apice attenuatis.

The new taxon is readily distinguished from variety *ferreana* by having distinctly exserted, acuminate bract scales that are lanceolate at the apex and neither reflexed nor recurved. In contrast, variety *ferreana* has usually reflexed or recurved bract scales that are rounded at the apex with an acute cusp.

Abies beshanzuensis M. H. Wu var. **ziyuanensis** (L. K. Fu & S. L. Mo) L. K. Fu & Nan Li, comb. et stat. nov. Basionym: *Abies ziyuanensis* L. K. Fu & S. L. Mo, Acta Phytotax. Sin. 18: 208. 1980. TYPE: China. Guangxi: Ziyuan Xian, Yinzhulao Shan, 1650–1700 m, *L. K. Fu & Y. J. Lü 78001* (holotype, PE).

Abies dayuanensis Q. X. Liu, Bull. Bot. Res., Harbin 8(3): 85. 1988. Syn. nov. TYPE: China. Hunan: Ling-Xian Dayuan, Xopingao, 1450 m, Sep. 1986, *Zhang Canming 202* (holotype, HUIF).

Abies beshanzuensis var. *ziyuanensis* differs from variety *beshanzuensis* in having green-brown or dark brown, cylindric-ellipsoid seed cones, wider seed scales (ca. 3.3 cm wide) at the middle of the cones, and conical winter buds. In contrast, variety *beshanzuensis* has light brown or yellow-brown seed cones, narrower seed scales (2.5–3 cm wide), and ovoid winter buds. Variety *ziyuanensis* is quite similar in other aspects to variety *beshanzuensis* and was previously treated as a distinct species. It has recently been collected from Jiangxi (Jinggang Shan) and E Hunan (Lin Xian) and, therefore, does not appear to be as geographically isolated as once thought.

Keteleeria fortunei (A. Murray) Carrière var. **oblonga** (Cheng & L. K. Fu) L. K. Fu & Nan Li, comb. et stat. nov. Basionym: *Keteleeria oblonga* Cheng & L. K. Fu, Acta Phytotax. Sin. 13(4): 82. 1975. TYPE: China. W Guangxi: Tianyang, 380–680 m, *Z. Z. Chen 54163* (holotype PE).

Variety *oblonga* differs from variety *fortunei* in having very thin, oblong seed scales and dark leaf scars obviously protruded on branchlets. Variety *fortunei* has thick, oblate, truncate-rounded seed scales, and its leaf scars are not distinctly protruded on branchlets.

Larix gmelinii (Ruprecht) Ruprecht f. **pendula** (D. S. Zhang & Y. M. Chen) L. K. Fu & Nan Li, comb. et stat. nov. Basionym: *Larix principis-ruprechtii* Mayr var. *pendula* D. S. Zhang & Y. M. Chen, J. Beijing Forest. Univ. 10(2): 113. 1988. TYPE: China. Hebei: Wulin Shan, 1700 m, *D. S. Zhang 87206* (holotype, BJFC).

Forma *pendula* is distinguished from forma *prin-*

cipis-ruprechtii in having pendulous long branchlets and leaves to 3.5 cm long. The latter form has branches spreading horizontally but the upper ones ascending, long branchlets not pendulous, and leaves 1.5–3 cm long.

Larix gmelinii (Ruprecht) Ruprecht f. **genhensis** (S. Y. Li & K. T. Adair) L. K. Fu & Nan Li, comb. et stat. nov. Basionym: *Larix gmelinii* var. *genhensis* S. Y. Li & K. T. Adair, Sida 16(1): 183. 1994. TYPE: China. Nei Mongol: Genhe, *S. Y. Li 861-643* (holotype, NEFI).

This form is distinguished from typical plants of variety *gmelinii* by its long and pendulous long branchlets.

Larix potaninii Batalin var. **chinensis** (Beissner) L. K. Fu & Nan Li, comb. et stat. nov. Basionym: *Larix chinensis* Beissner, Mitt. Deutsch. Dendrol. Ges. 5: 215. 1896. TYPE: China. S Shaanxi: Taibai Shan, 3000 m, Aug. 1893–1984, *P. G. Giraldi s.n.* (holotype, BONN?).

Variety *chinensis* differs from variety *potaninii* in having pale, grayish, or brownish yellow first-year shoots and seed scales ± strigose abaxially. Variety *potaninii* has red-brown or purplish brown first-year shoots and seeds scales tuberculate and pubescent abaxially. It differs from variety *macrocarpa* in having smaller seed cones 2.5–5 × 1.5–2.8 cm and seed scales ± strigose abaxially. In variety *macrocarpa* the seed cones are 5–7.5 × 2.5–3.5 cm, and the seed scales are tuberculate and pubescent abaxially.

Picea asperata Masters var. **heterolepis** (Rehder & Wilson) L. K. Fu & Nan Li, comb. et stat. nov. Basionym: *Picea heterolepis* Rehder & Wilson, in Sargent, Pl. Wilson. 2: 24. 1914. TYPE: China. W Sichuan: Mao-chou [Guan Xian], 1600–2500 m, *E. H. Wilson 4064* (holotype, A; isotype, PE).

Variety *heterolepis* is readily distinguished from variety *asperata* in having seed scales 2-lobed apically. In variety *asperata* the seed scales are entire or rarely slightly denticulate.

Only a few sheets of variety *heterolepis* are available. Seeds collected by E. H. Wilson in October 1910 from Guan Xian, Sichuan, have been propagated and cultivated in some arboreta and gardens in Europe and the United States. All their offspring have seed scales that are evidently 2-lobed apically.

Picea meyeri Rehder & Wilson f. **pyramidalis** (H. W. Jen & C. G. Bai) L. K. Fu & Nan Li, comb. et stat. nov. Basionym: *Picea meyeri* var. *pyramidalis* H. W. Jen & C. G. Bai, J. Beijing Forest. Univ. 17(1): 95. 1995. TYPE: China. Nei Mongol: Hexigten Qi, 1300 m, *X. W. Ren 94001* (holotype, BJFC).

This form is recognized only by its narrowly conical crown and dense branches divergent at 35–45°. There are no other characters that distinguish it from typical plants of *Picea meyeri* and, therefore, it does not deserve a rank higher than form.

Pinus fenzeliana Handel-Mazzetti var. **dabeshanensis** (Cheng & Law) L. K. Fu & Nan Li, comb. et stat. nov. Basionym: *Pinus dabeshanensis* Cheng & Law, Acta Phytotax. Sin. 13(4): 85. 1975. TYPE: China. SW Anhui: Dabie Shan, 900–1400 m, *C. C. Chang 1* (holotype, PE).

Variety *dabeshanensis* differs from variety *fenzeliana* by its shorter needles 5–14 cm long, cylindric-ellipsoid seed cones ca. 14 cm, and pale brown seeds with a wing less than 2 mm long. In variety *fenzeliana* the needles are 10–28 cm long, the seed cones are ovoid-ellipsoid and 6–9 cm long, and the seeds are chestnut brown and with a wing 2–4(–7) mm long. The differences between the two taxa are primarily quantitative and somewhat continuous in nature, and that justifies their recognition at the varietal rank.

Silba (1990) treated this taxon as a variety of *P. armandi* Franchet. However, variety *dabeshanensis* appears to be more related to *P. fenzeliana*. Both *P. fenzeliana* var. *fenzeliana* and variety *dabeshanensis* have thin, easily breakable seed coats and are restricted in their distribution to the south of the Yangtze River. *Pinus armandi* has thick and hard seed coats and is widely distributed in China.

Pinus kwangtungensis Chun ex Tsiang var. **varifolia** Nan Li & Y. C. Zhong, var. nov. TYPE: China. SW Guangxi: Longing Xian, Tiandeng Xian, summits of limestone mountains, ca. 540 m, *Y. C. Zhong 80834* (holotype, PE; isotype, GXF).

A var. *kwangtungensi* recedit foliis variabilis in numero, 2–3(–5) in fasciculo, supra faciebus obsoletis stomatiferis instructis, strobilis minoribus, 3–4 cm longis, 1.5–2 cm latis.

Variety *varifolia* is easily distinguished from variety *kwangtungensis* by having needles 2–3(–5) per bundle, inconspicuous bands of stomata on the

adaxial leaf surface, and seeds cones 3–4 × 1.5–2 cm. In contrast, variety *kwangtungensis* has 5 needles per bundle, conspicuous white bands of stomata on the adaxial leaf surface, and seed cones 5–9(–17) × 3–7 cm.

Pseudotsuga sinensis Dode var. **wilsoniana** (Hayata) L. K. Fu & Nan Li, comb. et stat. nov. Basionym: *Pseudotsuga wilsoniana* Hayata, Icon. Pl. Formos. 5: 204. 1915. TYPE: China. Taiwan, *U. Mori s.n.* (holotype, TI).

Variety *wilsoniana* is quite similar to variety *sinensis* and differs primarily in having leaves with gray-green instead of white stomatal belts abaxially. It is endemic to Taiwan and, therefore, geographically isolated from variety *sinensis*, which is distributed in S Anhui, N. Fujian, NW and NE Guizhou, W Hubei, NW Hunan, NE Jiangxi, S Shaanxi, Sichuan, Central and NE Yunnan, and SW Zhejiang.

Tsuga oblongisquamata (Cheng & L. K. Fu) L. K. Fu & Nan Li, comb. et stat. nov. Basionym: *Tsuga chinensis* (Franchet) Pritzel var. *oblongisquamata* Cheng & L. K. Fu, Acta Phytotax. Sin. 13(4): 83. 1975. TYPE: China. Hubei: Badong, *H. C. Chow 950* (holotype, PE; isotypes, E, NY).

Tsuga oblongisquamata is related to *T. chinensis*, from which it is distinguished in having slender, longer, cylindric-ovoid or elongated ovoid seed cones, thinner seed scales, and elongated orbicular, glabrous, loosely arranged exposed parts as long as broad. *Tsuga sinensis* has ovoid-globose or obovoid-oblong seed cones and square-orbicular, pentagonal ovate, or oblate and densely arranged seed scales as long as or slightly longer than broad.

A comparison of *Tsuga oblongisquamata* with the American hemlocks reveals that it is quite similar to *T. caroliniana* Engelmann (southern Appalachian mountains), especially in their longer and slender seed cones and elongated orbicular, loosely arranged seed scales.

Tsuga chinensis (Franchet) Pritzel var. **patens** (Dowie) L. K. Fu & Nan Li, comb. et stat. nov. Basionym: *Tsuga patens* Downie, Notes Roy. Bot. Gard. Edinburgh 14: 16. 1923. TYPE: China. W Hubei: Changyang Xian, 1800–2200 m, *E. H. Wilson 2096*, p.p. (holotype, A).

Tsuga chinensis var. *patens* is distinguished by its relatively stout branchlets 1.5–2 mm diam., brownish yellow or brown, ovoid-globose seed cones 2–2.5 × 1.8–2.2 cm, thick seed scales, and almost square, smooth, and glossy exposed parts. Variety *chinensis* has slender branchlets ca. 1 mm diam., ovoid seed cones 1.5–2.5 × 1.2–1.6 cm, and pentagonal-ovate nearly square not glossy seed scales.

There are seven sheets of *Wilson 2096* in the herbarium of the Arnold Arboretum, and all are from W Hubei. Of these, only three belong to variety *patens*, and two of these are from Changyang Xian and the third is without an exact locality. The other four sheets of *Wilson 2096* belong to variety *chinensis* and were collected from Fang Xian and Xingshan Xian.

Cephalotaxus sinensis (Rehder & Wilson) Li var. **wilsoniana** (Hayata) L. K. Fu & Nan Li, comb. et stat. nov. Basionym: *Cephalotaxus wilsoniana* Hayata, Icon. Pl. Formos. 4: 22. 1914. TYPE: China. Taiwan, Mt. Arisan, *K. Uyematsu 18* (holotype, TI?).

This variety differs from variety *sinensis* in having slightly falcate, longer (3–4 cm) leaves with a rounded-cuneate base and slightly revolute margin. Variety *sinensis* has straight or occasionally curved, shorter leaves (less than 3 cm long) with a rounded base and non-revolute margin.

Taxus wallichiana Zuccarini var. **mairei** (Lemée & H. Léveillé) L. K. Fu & Nan Li, comb. et stat. nov. Basionym: *Tsuga mairei* Lemée & H. Léveillé, Monde Pl. ser. 2, 16: 20. 1914. TYPE: China. Yunnan: Dongchuan, *E. E. Mair s.n.* (holotype, E).

Taxus wallichiana var. *mairei* differs from variety *wallichiana* and variety *chinensis* (Pilger) Florin in having glossy, falcate leaves 2–3.5 cm × 3–4(–5) mm with a tapering apex, abaxial middle bands without papillae, and a slightly revolute or flat margin when dry.

The variety is widespread in the plains and mountains (usually below 1000–1200 m) in China (S Anhui, Fujian, S Gansu, N Guangdong, N Guangxi, Guizhou, W Henan, W Hubei, Hunan, S Shaanxi, Sichuan, Taiwan, E Yunnan, and Zhejiang), India, Malaysia, Myanmar, the Philippines, and Sumatra.

Taxus fuana Nan Li & R. R. Mill, sp. nov. TYPE: China. Xizang: Jilong, 3000 m, *Qingzhang Expedition 7032* (holotype, PE).

Species similis *T. wallichianae* Zuccarini, sed foliis dense, irregulariter que distichis, angustatis et rectis, linearibus, (1.2–)2.5–3.7 cm longis, apice acutis, margine

plus minusve revolutis, seminibus oblongo-cylindricis, superne leviter compressis, apice rostellibus differt.

Trees or shrubs. Branchlets green, drying pale brown-yellow, golden or pale brown in the first year, aging pale or red brown. Winter buds ovoid; scales at base of shoots keeled abaxially. Leaves densely arranged in 2 irregular rows, spreading V-shaped, linear, (1.2–)2.5–3.7 cm × 1.5–2.5 mm, slender, straight, upper parts almost as broad as the lower parts, margin ± revolute, apex abruptly pointed. Seeds cylindric-oblong, ca. 6.5 × 4.5–5 mm, somewhat compressed, with slightly obtuse lateral ridges in upper parts, apex obtuse and with a mucro, enclosed for more than ½ length in a cup-shaped, red succulent aril; hilum ellipsoid.

Cheng and Fu (1978: 440) recognized and illustrated two species of *Taxus* from SW China. The plants restricted to SW Xizang were identified as *T. wallichiana* Zuccarini, and the species was said to have slender, straight, linear leaves that are uniform in width, abruptly acute at the apex, and densely arranged in two irregular rows. The second species, which is distributed in SW Sichuan, W Yunnan, and SE Xizang, was recognized as *T. yunnanensis* Cheng & L. K. Fu and was said to have loosely and pectinately arranged, lanceolate or linear-lanceolate, ± falcate leaves that are tapered at the apex and with lower parts obviously broader than the upper. Critical study of types and authentic material, both in China and Europe, clearly reveals that *T. wallichiana* has falcate, loosely and pectinately arranged leaves, and it is conspecific with the plants recognized by Cheng and Fu (1978) as *T. yunnanensis*. Therefore, *T. yunnanensis* should be reduced to a synonym of *T. wallichiana*, and the plants recognized by Cheng and Fu (1978) as *T. wallichiana* should be described as a new species, *T. fuana* Nan Li & R. R. Mill. The species is named in honor of Professor Fu Li-kuo for his life's work on the taxonomy of Chinese gymnosperms. *Taxus fuana* is represented by an excellent illustration in Cheng and Fu (1978: 440, p. 100, figs. 1–3).

Paratypes. INDIA. Deoban, Chakrata, *Maheshwan s.n.* (E); Tirjugi, Narain, N Gashwal, *Ram 8894* (E); Punjab, *Drummond 26626* (E), *Gamble 23507* (K). KASHMIR. Judia, *Johnston 3955* (E). NEPAL. Kali, *Stainton et al. 734, 4832* (E); S Tukucha, Lete, *Stainton et al. 734* (E). PAKISTAN. Punjab, *Rodin 5313* (K).

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A New Species of *Tournefortia* (Boraginaceae) from Peru

James S. Miller
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. *Tournefortia delicatula* J. S. Miller is newly described from cloud forest ridges in the Tumbes province of northwestern Peru. This distinctive species is known only from the type collection and differs from other species with which it might be confused in its delicate growth habit with slender twigs and inflorescence branches, and by its filiform calyx lobes, relatively large, funnelform corolla with a slender tube and large lobes, and very short style.

The genus *Tournefortia* probably contains more than 150 species that are widely distributed in the tropics. Only a few occur in the Old World: the majority are found in Latin America, with the greatest concentration in the Andean countries of South America. Except for treatment in floras, the most modern treatments available for the South American species are those by Johnston (1930, 1935), but neither of his two publications cover the Andean countries. Ellsworth P. Killip prepared a nearly complete manuscript entitled "The Andean species of *Tournefortia*," several versions of which still exist at the Smithsonian Institution, but for some reason this was never completed and published.

Macbride (1960) treated 22 species of *Tournefortia* in the *Flora of Peru*, and 26 species were recognized by Brako (1993). The new species described below is one of a number of novelties recently collected in Andean South America (Miller, 1989, 1995).

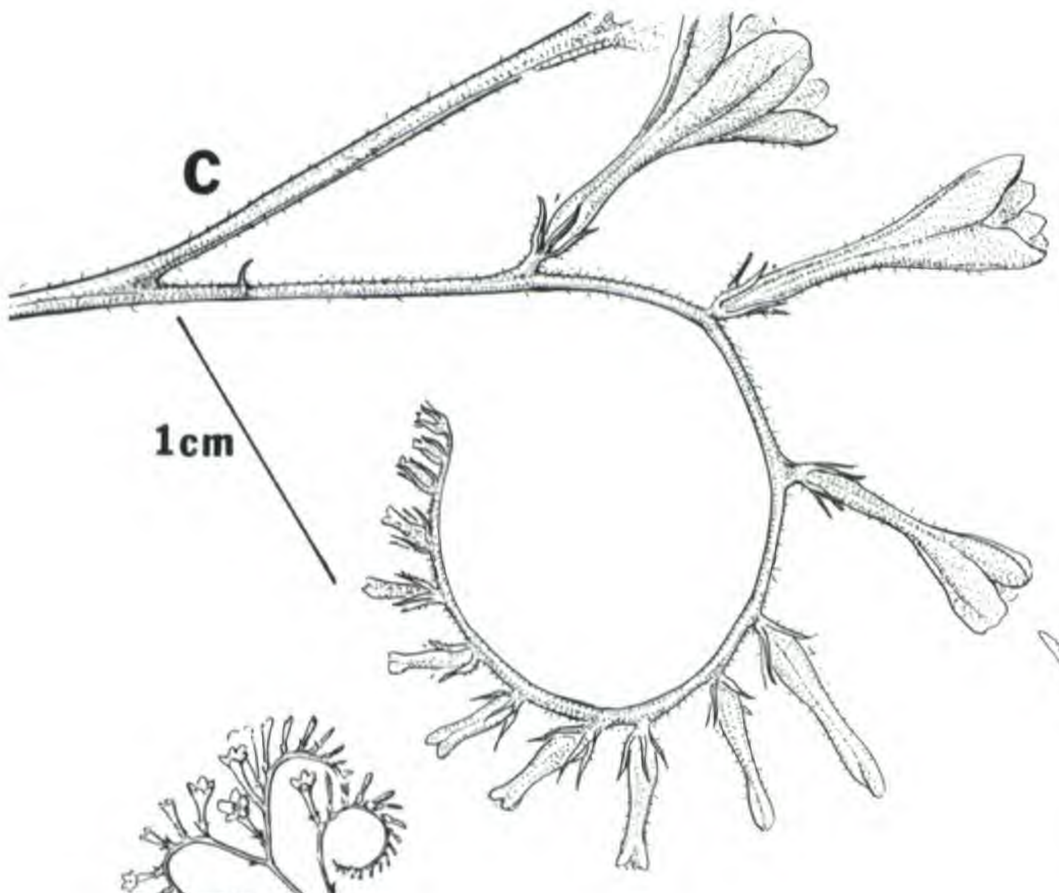
Tournefortia delicatula J. S. Miller, sp. nov. TYPE: Peru. Tumbes: Sarumilla, Matapalo, "El Caucho Campo Verde," Parcela "E" de evaluación permanente, 700 m, 19 Jan. 1991 (fl), *C. Díaz, H. Osores, R. Rizari, D. Díaz & D. Castañeda 7438* (holotype, MO 4990117; isotypes, GH, US, USM). Figure 1.

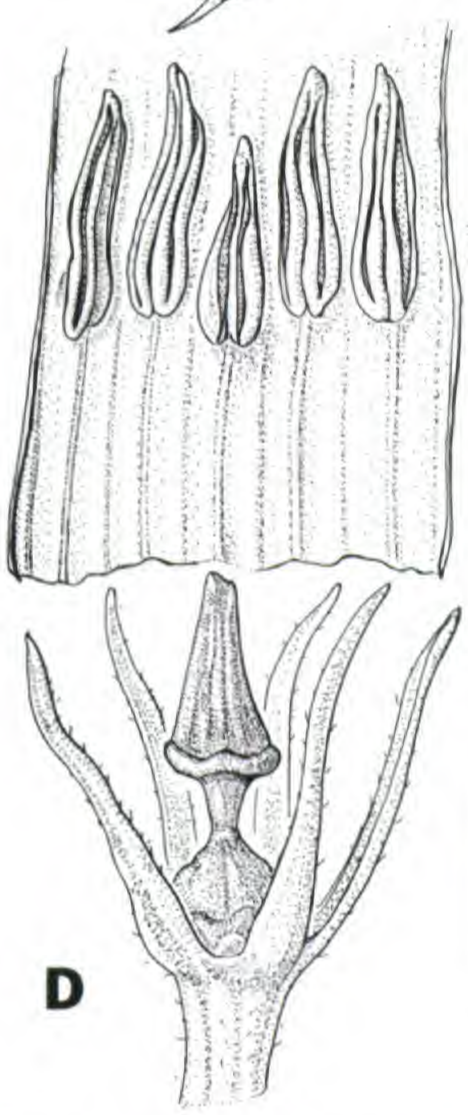
Frutex usque ad 1.5 m altus, ramulis glabris. Folia alterna; lamina elliptico-oblonga, 7–15 cm longa, 2.3–4.2 cm lata, apice acuminata, basi cuneata usque ad decurrente, glabra; petiolo 7–14 mm longo. Inflorescentia terminalis ex cyma bis dichotoma, flores sessiles subsessilesve inter se 3–7 mm distantes gerente constans. Flos sepalis filiformibus, 1.6–2 mm longis; corolla alba, infundibulari, 9–11 mm longa, lobulis oblongis, 3–3.5 mm longis; antheris lanceoloideis, 1.5 mm longis; stigmate conoideo, sessili, subsessilive.

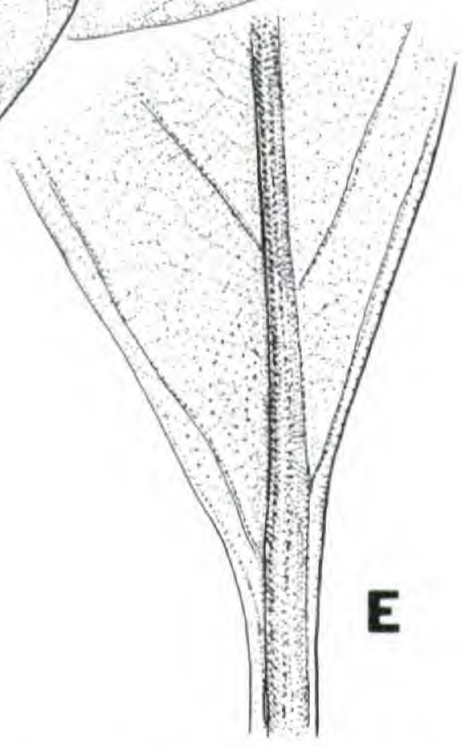
Shrub 1.5 m tall, the twigs glabrous, the young branchlets slender, ca. 1 mm diam., drying black. Leaves alternate, the blades membranaceous, narrowly elliptic-oblong, 7–15 cm long, 2.3–4.2 cm wide, the apex gradually long-acuminate, the base cuneate to decurrent, the margin entire, both surfaces glabrous, the venation brochidodromous, the midrib impressed above, the secondary veins 5–7; petiole 7–14 mm long, slender, glabrous. Inflorescence terminal, a delicate, twice dichotomously branched cyme, the peduncle 4–8 cm long, slender, glabrous, the branches sparsely and minutely puberulent, the flowers borne 3–7 mm apart, sessile or with the pedicel adnate to the branch or free for ca. 1 mm. Flowers bisexual; sepals filiform, 1.6–2 mm long, with scattered, siliceous hairs; corolla white, funnelform, 9–11 mm long, the limb 5.5–7 mm long, 5-lobed, with 5 distinct ribs, each ending in the midrib of a lobe, the lobes oblong and rounded at the apex, 3–3.5 mm long, 2–2.5 mm wide, the tube 3.5–4 mm long, ca. 1 mm diam., the basal portion of the outer corolla surface minutely and sparsely puberulent with most of the trichomes on the ribs; stamens 5, the filaments ca. 2 mm long, completely adnate to the corolla tube, the anthers lanceoloid, ca. 1.5 mm long; ovary ovoid, ca. 0.5 mm tall, glabrous, the style nearly absent or less than 0.5 mm long, the stigma conical with the sterile portion extending ca. 1 mm above a prominent basal annular ring. Fruits unknown.

Tournefortia delicatula is known only from the type collection from an isolated cloud forest ridge in northwestern Peru, just south of the Ecuadorian border in Tumbes province. It is a distinctive species and differs from others in the genus by its delicate growth habit with very slender branches and inflorescences, filiform calyx lobes, and funnelform corolla with expanded, oblong lobes that are unique in the genus. While clearly a member of *Tournefortia* sect. *Tournefortia* (Johnston, 1930; Killip, unpublished), its relationships with other species of the section are obscure.

Acknowledgments. I thank Camilo Díaz for providing additional information about the collection,







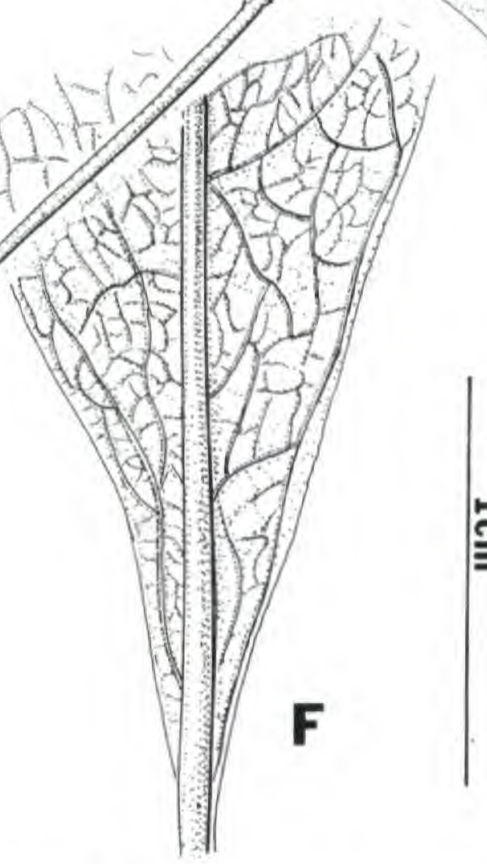


Figure 1. *Tournefortia delicatula* J. S. Miller. —A. Habit. —B. Flower. —C. Inflorescence branch. —D. Flower showing mature ovary with style and opened corolla tube with inserted anthers. —E. Adaxial surface of leaf base. —F. Abaxial surface of leaf base.

Roy Gereau for help with the Latin description, and John K. Myers for the illustration. I also thank the Smithsonian Institution, and Joan Nowicke in particular, for making E. P. Killip's unpublished manuscript available.

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A Synopsis of *Korthalsella* (Viscaceae)

Mia Molvray
Department of Biological Sciences, Loyola University, New Orleans, Louisiana 70118, U.S.A.
mm03kg@lion.rbgkew.org.uk

ABSTRACT. In preparation for forthcoming publications on allozymes and the ITS region of nuclear DNA of *Korthalsella*, a synopsis of the genus is presented. Only names in current use are listed; a complete taxonomic revision will be published separately. Molecular evidence, as well as morphometric evaluation of branch shape characters and anatomical results have shown that a realignment of *Korthalsella* sections and species is needed. The changes involve new delimitations and combinations. A key to the eight species of *Korthalsella* is presented. The following species are recognized: *Korthalsella geminata* (Korthals) Engler, *K. papuana* Danser, *K. taenioides* (Commerson ex DC.) Engler, including six forms, *K. cylindrica* (Tieghem) Engler, *K. japonica* (Thunberg) Engler, including three forms, *K. salicornioides* (A. Cunningham) Tieghem, *K. lindsayi* (Oliver ex Hooker f.) Engler, *K. lindsayi* var. *clavata* (Kirk) Danser, and *K. dacrydii* (Ridley) Danser.

The taxonomy of *Korthalsella*, a genus of mistletoes with highly reduced leaves and flowers, has been problematic from the outset. Van Tieghem (1896) first monographed the taxon as a tribe with three genera. He described over 60 species largely on the basis of minute variations in shape and size of the segments composing the articulated branches. Engler (1897) reduced the genera to sections of *Korthalsella* and made some new combinations. Danser (1937, 1940) completed the most recent monograph, in which he maintained Engler's 3 sections, and reduced Van Tieghem's numerous species and those added by later workers (e.g., Lecomte, 1916) to 22 species and 10 varieties, including 3 new species he described.

Danser delimited sections by the presence or absence of specialized inflorescence branches and distichous or decussate cladotaxy. Studies of living plants showed that cladotaxy is an unreliable character at any level, since members of one population sometimes exhibit the full range of character states. Sections in the present work are delimited as follows: vegetative branches flattened and inflorescence branches terete, vascular bundles eight or more, section *Heterixia*; vegetative and flowering branches similar in appearance, vascular bundles eight or more, section *Korthalsella*; and vascular bundles four or fewer, section *Bifaria*. These sectional delimitations, however, are still under study and may prove to need revision.

Three of Danser's species were recognized on the basis of inflorescence characters; the other nineteen, and all ten varieties, were delimited on the basis of segment shape or plant size. Some, though not all, of his taxa were difficult to identify from descriptions alone, so botanists tended to use a "biogeographic" species concept in practice, identifying specimens based on locality rather than congruence with the protologue. Studies briefly enumerated below indicated that shape and size characters were indeed unreliable in many cases, and that eight species can be recognized on the basis of flower number per inflorescence, strictly defined size and shape characters, and host plants.

Shape and size are quantitative characters that can be evaluated using morphometric techniques. Statistical analysis of measurement data showed that a large complex of species within the section *Bifaria* were not distinguishable using shape or size. These taxa are currently placed in *Korthalsella taenioides* and *K. japonica*.

Anatomical work revealed that the number of major vascular bundles varied discretely between eight or more (seven or six in a few specimens) and four or fewer. *Korthalsella opuntia* sensu Danser (1937), correctly called *K. japonica* (Thunberg) Engler (Merrill, 1916), was found to have elements with both vascular bundle numbers. The type specimen of *K. japonica* has four vascular bundles; the earliest valid name for the eight-bundle elements is *K. taenioides* (Commerson ex DC.) Engler.

Molecular work has confirmed both the morphometric and anatomical species delimitations. Allozymes have been studied in 28 populations of five of the seven species using 25 loci in 11 enzyme systems. This study included all the problem taxa in the genus except *K. dacrydii*, a rare species known only from a few Malayan and Javan collections. Sequences of the ITS region are confirming the allozyme data. Both molecular approaches sup-

port a monophyletic sibling species found only on *Metrosideros*, *K. cylindrica*, which sometimes has very strict distichous or decussate cladotaxy, but is not otherwise obviously distinct from *K. taenioides* forma *remyana*.

Taxonomy

Korthalsella Tieghem, Bull. Soc. Bot. France 43: 83. 1896. TYPE: *Korthalsella remyana* Tieghem.

Monoecious, perennial, hemiparasitic herbs, the host usually dicotyledonous trees, 2–60 cm long from base to apex, articulated at the nodes, the segments terete to strongly complanate, forming cladodes, inflorescences axillary at each node, opposite, the whole mass of flowers forming a cushion-like structure, the flowers surrounded by unicellular or multicellular trichomes; staminate and pistillate flowers sessile, 0.4–0.8 mm diam. at broadest point, with 3 persistent tepals; anthers 3, 2-locular, connate into a synandrium, the pollen dehiscing into a central chamber and exuded through the apical pore of the synandrium; fruit globose to ellipsoid, less than 3 mm long, dehiscence weakly explosive; chromosome number: $n = 14$.

Distribution. Madagascar, Mascarene Islands, isolated collections in Africa (Kenya, Ethiopia, Socotra), Himalaya, southern China, Ryukyu and Bonin Islands, southern Japan, Indomalaysia, Papuasia, Australia (Western Australia, Northern Territory, South Australia, Queensland, New South Wales, Victoria), New Zealand, volcanic islands of the Pacific, extending to the Hawaiian Islands.

Key to the Species of *Korthalsella*

1a. Branch vascular bundles 8 or more (rarely 7 or 6).
  2a. Flowering branches terete and vegetative branches flattened (section *Heterixia*).
    3a. Inflorescence composed of triads of flowers . . . . . 1. *K. geminata*
    3b. Inflorescences composed of many flowers . . . . . 2. *K. papuana*
  2b. Flowering and vegetative branches similar in shape (section *Korthalsella*).
    4a. Plants growing on *Metrosideros*. . . . . 4. *K. cylindrica*
    4b. Plants growing on other hosts . . . . . 3. *K. taenioides*
1b. Branch vascular bundles 4 or fewer (section *Bifaria*).
  5a. Flowering branches terete and vegetative branches flattened . . . . . 6. *K. lindsayi*
  5b. Flowering and vegetative branches similar in shape.
    6a. Mature plants more than 8 cm long, branch segments usually obovate and flattened . . . . 5. *K. japonica*
    6b. Mature plants less than 8 cm long, branch segments small and cylindrical or subcylindrical.
      7a. Plants growing on angiosperms . . . . . 7. *K. salicornioides*
      7b. Plants growing on gymnosperms (*Dacrydium*) . . . . . 8. *K. dacrydii*

1. Korthalsella geminata (Korthals) Engler, Nat. Pflanzenfam. Nachtr. 3. 138. 1897. *Viscum geminatum* Korthals, Verh. Batav. Genootsch. Kunsten 17: 259. 1839. TYPE: Southeast Borneo. Summit of Mt. Sakoembang, 930 m, *Korthals s.n.* (holotype, L (sheet no. 6415 #12 & #13); isotype, U).

Distribution. Borneo, Sumatra.

2. Korthalsella papuana Danser, Blumea 3: 53. 1938. TYPE: Papua New Guinea. Crest of the main ridge NW of The Gap, *Carr 15120* (holotype, L; isotypes, A, LAE).

Distribution. Northern Queensland, tropical rainforest canopy; Sumatra; New Guinea.

3. Korthalsella taenioides (Commerson ex DC.) Engler, Nat. Pflanzenfam. Nachtr. 3. 138. 1897. *Viscum taenioides* Commerson ex DC., Prodr. 4: 283. (Sept.) 1830. TYPE: Mascarene Islands. Réunion, 1771, *Commerson s.n.* (lectotype, designated here, G).

Distribution. The most widely distributed species in the genus, found on the volcanic islands of the Pacific, Lord Howe and Norfolk Islands, Australia (Queensland, New South Wales, Victoria), New Hebrides, Loyalties, Solomons, New Caledonia, Rossel Island near New Guinea, Malaysia, Mascarenes Islands, perhaps Madagascar (no recent collections), and east Africa.

Key to the Forms of *Korthalsella taenioides*

1a. Branches complanate.
  2a. Individual segments broader than long or nearly square, the ratio of length to width 1.1 or less . . . . . 3d. f. *pendula*
  2b. Individual segments longer than broad, the ratio of length to width greater than 1.1.

3a. Segments broadly elliptical, sometimes approaching suborbicular . . . . . 3f. f. *emersa*
3b. Segments oblong or rectangular.
4a. Nodes strongly constricted; segments very large, basal segments commonly longer than 40 mm, medium-sized segments commonly longer than 25 mm . . . . . 3e. f. *disticha*
4b. Nodes weakly to not constricted; segments smaller than above . . . . . 3a. f. *taenioides*
1b. Branches cylindrical, sometimes approaching elliptical in cross section in specimens with long segments.
5a. Segments cylindrical and short, usually less than 15 mm . . . . . 3b. f. *remyana*
5b. Segments elliptical in cross section and elongate, the medium-sized segments commonly more than 15 mm long, the large segments commonly more than 20 mm long . . . . . 3c. f. *horneana*

Notes on delimitation of the forms. Korthalsella taenioides is a highly polymorphic species with recognizable extreme forms that represent outliers along a continuum of shape and size variation. Owing to the continuous nature of the variation the lowest taxonomic rank has been used, and arithmetic definition of the forms facilitates reproducible identification of specimens. This approach seems preferable to recognizing a single polymorphic taxon without providing a means to identify extreme forms when necessary.

3a. Korthalsella taenioides (Commerson ex DC.) Engler f. **taenioides**

Bifaria commersoni Tieghem, Bull. Soc. Bot. France 43: 176. 1896. *Korthalsella commersoni* (Tieghem) Danser, Bull. Jard. Bot. Buitenzorg 14: 154. 1937. TYPE: Madagascar. 1770 or 1771, *Commerson s.n.* (holotype, P; isotype, G).

Bifaria complanata Tieghem, Bull. Soc. Bot. France 43: 167. 1896. *Korthalsella complanata* (Tieghem) Engler, Nat. Pflanzenfam. Nachtr. 3. 138. 1897. TYPE: Hawaiian Islands. Maui, on *Osmanthus*, 1851–1855, *Rémy 504-Maui* (holotype, P; isotypes, A, BISH).

Bifaria dichotoma Tieghem, Bull. Soc. Bot. France 43: 171. 1896. *Korthalsella dichotoma* (Tieghem) Engler, Nat. Pflanzenfam. Nachtr. 3. 138. 1897. SYNTYPES: New Caledonia. Island Art, *Montrousier 200* (G); 1871, *Balansa 3169a* (P).

Bifaria balansae Tieghem, Bull. Soc. Bot. France 43: 172. 1896. *Korthalsella dichotoma* (Tieghem) Engler var. *balansae* (Tieghem) Danser, Bull. Jard. Bot. Buitenzorg 14: 142. 1937. TYPE: New Caledonia. Hills above Conception, 1869, *Balansa 1320* (holotype, P; isotype, US).

Bifaria platycaula Tieghem, Bull. Soc. Bot. France 43: 170. 1896. *Korthalsella platycaula* (Tieghem) Engler, Nat. Pflanzenfam. Nachtr. 3. 138. 1897. TYPE: Society Islands. Tahiti, illegible locality that may read "Vulz. Pinpapa," 1834, *Moerenhout s.n.* (holotype, P; isotype, G).

Bifaria vitiensis Tieghem, Bull. Soc. Bot. France 43: 170. 1896. *Korthalsella platycaula* (Tieghem) Engler var. *vitiensis* (Tieghem) Danser, Bull. Jard. Bot. Buitenzorg 16: 337. 1940. TYPE: Fijian Islands. 1840. Without specific locality, but the collection must have come from either Vanua Levu or Ovalau (vide Smith, 1985). On *Inocarpus*. U.S. Expl. Exped. (holotype, P; isotype, US 78373).

Korthalsella rapensis F. Brown, Bernice P. Bishop Mus. Bull. 130: 57. 1935. *Korthalsella platycaula* (Tieghem) Engler var. *rapensis* (F. Brown) Danser, Bull. Jard. Bot. Buitenzorg 16: 337. 1940. TYPE: Tubuai Islands. Rapa, Pake Bay, Tauloko, near shore, on *Celtis paniculata*, 1920s, *Stokes 465* (holotype, BISH).

Bifaria bojeri Tieghem, Bull. Soc. Bot. France 43: 176. 1896. *Korthalsella opuntia* var. *bojeri* (Tieghem) Danser, Bull. Jard. Bot. Buitenzorg 14: 138. 1937. SYNTYPES: Mascarene Islands. Mauritius, on *Antidesma madagascariense*, 1833, *Bojer s.n.* (G, P).

Bifaria gaudichaudii Tieghem, Bull. Soc. Bot. France 43: 176. 1896. *Korthalsella opuntia* var. *gaudichaudii* (Tieghem) Danser, Bull. Jard. Bot. Buitenzorg 14: 138. 1937. TYPE: Mascarene Islands. Réunion, Voy. Bonité, 1837, *Gaudichaud s.n.* (P).

Bifaria richardii Tieghem, Bull. Soc. Bot. France 43: 176. 1896. *Korthalsella opuntia* var. *richardii* (Tieghem) Danser, Bull. Jard. Bot. Buitenzorg 14: 141. 1937. SYNTYPES: Mascarene Islands. Réunion, forests at Salazie, *Richard 218* and *219* (P).

Korthalsella degeneri Danser, in Degener, Fl. Hawaii. Fam. 105, p.p. 1938. TYPE: Hawaiian Islands. Oahu, Makua Valley, base of Piko trail, 1000 ft., on *Sapindus oahuensis*, *Degener 11870* p.p. (A, G, K, L p.p., MO, NSW). (L p. alt. *K. taenioides* f. *horneana*.)

Korthalsella binii Pichi-Sermolli, Missione Stazione Lago Tana 7: 31. 1951. TYPE: Africa. Ethiopia, on the shores of Lake Tana, *Pichi-Sermolli 2487* (holotype, FI "Herb. Colon. Florent.").

Korthalsella cylindrica (Tieghem) Engler var. *planiuscula* Danser, Bull. Jard. Bot. Buitenzorg 14: 132. 1937. TYPE: Hawaiian Islands. Oahu, Waiolani, no date, *Wawra 1971* (holotype, W apparently lost).

Bifaria crassa Tieghem, Bull. Soc. Bot. France 43: 167. 1896. *Korthalsella latissima* (Tieghem) Danser var. *crassa* (Tieghem) Danser, Bull. Jard. Bot. Buitenzorg 14: 153. 1937. TYPE: Hawaiian Islands. *Rémy 504-Hawaii* (holotype, P; isotype, A).

Korthalsella wawrae Tieghem, Bull. Soc. Bot. France 43: 164. 1896. *Korthalsella remyana* Tieghem var. *wawrae* Danser, Bull. Jard. Bot. Buitenzorg 14: 127. 1937. TYPE: Hawaiian Islands. Kauai, Pohakupili, *Wawra 2054* (holotype, W apparently lost).

Korthalsella rubra (Tieghem) Engler subsp. *geijericola* Barlow, Brunonia 6: 54. 1983. TYPE: Australia. New South Wales, Wee Waa, 21 Oct. 1920, *Withers s.n.* (holotype, NSW).

Distribution. Mascarene Islands, isolated collections in Kenya, Ethiopia and Socotra, Malay peninsula, Papuasia, Australia (Queensland, New South Wales, Victoria), volcanic islands of the Pacific, extending to the Hawaiian Islands.

Korthalsella opuntia, the most widely used name in the genus, was misapplied and requires some

explanation. Thunberg (1784) cited a valid Linnaean species, *Viscum opuntioides*, in synonymy when he published *Viscum opuntia*, rendering his name nomenclaturally superfluous. Thunberg later realized his taxon was distinct from *V. opuntioides* L. and redescribed it as *V. japonicum* Thunberg (1794), the earliest valid epithet in what was to become *Korthalsella*. Engler (1897) published a new combination in *Korthalsella* based on Thunberg's later epithet (*V. japonicum*). Merrill (1916) incorrectly used the earlier epithet, *opuntia*, ignoring Engler's valid and effective combination *K. japonica* (Thunberg) Engler. Thus, *K. opuntia* (Thunberg) Merrill was nomenclaturally superfluous. This difficulty with *K. opuntia* was first noted by Eichler (1965) and corrected by Barlow (1983).

3b. Korthalsella taenioides (Commerson ex DC.) Engler f. **remyana** (Tieghem) Molvray, comb. et stat. nov. Basionym: *Korthalsella remyana* Tieghem, Bull. Soc. Bot. France 43: 86. 1896. TYPE: Hawaiiian Islands. Oahu, on *Diospyros, Rémy 502-Oahu* (holotype, P; isotype, L).

Distribution. Reported from the Hawaiian Islands and Tahiti.

3c. Korthalsella taenioides (Commerson ex DC.) Engler f. **horneana** (Tieghem) Molvray, comb. et stat. nov. Basionym: *Korthalsella horneana* Tieghem, Bull. Soc. Bot. France 43: 164. 1896. TYPE: Fijian Islands. Viti Levu, Mt Koromba, viii/187, *Horne 894* (holotype, P; isotypes, BO, GH, K).

Korthalsella degeneri Danser, in Degener, Fl. Hawaii. Fam. 105, p. p. 1938. TYPE: Hawaiian Islands. Oahu, Makua Valley, base of Piko Trail, 1000 ft., on *Sapindus oahuensis, Degener 11870.* p. p. (L 6415). (p. alt. *K. taenioides* f. *taenioides.*)

Distribution. Reported from the Hawaiian Islands, Marquesas, Tahiti, Samoa, Fiji, and Norfolk Island.

3d. Korthalsella taenioides (Commerson ex DC.) Engler f. **pendula** (Wawra) Molvray, comb. nov. Basionym: *Viscum moniliforme* Blume [var. *planum* Wawra] forma *pendula* Wawra, Beiträge Fl. Haw. Inseln, Fortsetzung 56: 139. 1873. *Bifaria latissima* Tieghem, Bull. Soc. Bot. France 43: 168. 1896. *Korthalsella latissima* (Tieghem) Danser, Bull. Jard. Bot. Buitenzorg 14: 150. 1937. TYPE: Hawaiian Islands. Kauai, Halemanu, *Wawra 2139* (P).

Bifaria breviarticulata Tieghem, Bull. Soc. Bot. France 43: 173. 1896. *Korthalsella breviarticulata* (Tieghem) Danser, Bull. Jard. Bot. Buitenzorg 16: 339. 1940. TYPE: Australia. Queensland, close to Brisbane, Gowrie Mtn., on *Croton insulare*, no date, *Bailey 1065* (holotype, B lost; lectotype, designated here, BRI; isolectotypes, K, NSW).

Distribution. Reported from the Hawaiian Islands, southern Queensland, and one collection from Dungog, New South Wales.

3e. Korthalsella taenioides (Commerson ex DC.) Engler f. **disticha** (Endlicher) Molvray, comb. et stat. nov. Basionym: *Viscum distichum* Endlicher, Prodr. Fl. Norfolk. 61. 1833. *Korthalsella disticha* (Endlicher) Engler, Nat. Pflanzenfam. Nachtr. 3. 138. 1897. TYPE: Norfolk Island, 1804–1805, *Bauer s.n.* (holotype, W apparently lost; isotype, P).

Distribution. Reported from Norfolk Island, isolated collections from Fiji, and the Austral islands.

3f. Korthalsella taenioides (Commerson ex DC.) Engler f. **emersa** (Barlow) Molvray, comb. et stat. nov. Basionym: *Korthalsella emersa* Barlow, Brunonia 6: 44. 1983. TYPE: Australia. Lord Howe Island, Mt. Eliza, ca. 100 m, on *Elaeodendron, Balgooy 1037* (holotype, CANB).

Distribution. Reported from Lord Howe Island, New Caledonia, and isolated collections from Norfolk Island.

4. Korthalsella cylindrica (Tieghem) Engler, Nat. Pflanzenfam. Nachtr. 3. 138. 1897. Basionym: *Bifaria cylindrica* Tieghem, Bull. Soc. Bot. France 43: 166. 1896. TYPE: Hawaiian Islands. Lanai, on *Metrosideros, Rémy 502-Lanai* (P).

Distribution. Hawaiian Islands, Tahiti.

5. Korthalsella japonica (Thunberg) Engler, Nat. Pflanzenfam. Nachtr. 3. 138. 1897. *Viscum japonicum* Thunberg, Trans. Linn. Soc. London 2: 329. 1794. TYPE: Thunberg Herbarium specimen labeled *Viscum japonicum* (holotype, UPS).

Distribution. New Caledonia, Australia (Queensland, New South Wales, South Australia, Western Australia), Philippines, Japan, China, India, Himalaya, Ceylon, Afghanistan, and the Mascarene Islands.

KEY TO THE FORMS OF *KORTHALSELLA JAPONICA*

1a. Plants large, commonly 15 cm or longer; mature segments usually greater than 10 mm long, basal segments often greater than 17 mm long . . . . . 5b. f. *rubra*

1b. Plants usually 8–15 cm long; mature segments usually smaller than 10 mm long, basal segments usually less than 15 mm long.

2a. Segments short, slender, and terete or nearly so . . . . . 5c. f. *grayi*

2b. Segments relatively flat . . . . . 5a. f. *japonica*

5a. Korthalsella japonica (Thunberg) Engler f. **japonica**

Bifaria fasciculata Tieghem, Bull. Soc. Bot. France 43: 173. 1896. *Korthalsella opuntia* Danser var. *fasciculata* (Tieghem) Danser, Bull. Jard. Bot. Buitenzorg 14: 138. 1937. TYPE: China. Eastern Su-tchuen, (Dist. Tchen-keou-tin), *Farges s.n.* (P).

Korthalsella brassiana Blakely, Proc. Roy. Soc. Queensland 47: 79. 1936. *Korthalsella japonica* (Thunberg) Engler subsp. *brassiana* (Blakely) Barlow, Brunonia 6: 47. 1983. TYPE: Australia. North Queensland, Thornton's Peak 4000–4500 ft., *Brass 2298* (holotype, NSW; isotypes, A, BRI).

Korthalsella leucothrix Barlow, Brunonia 6: 48. 1983. TYPE: Western Australia, Wanarra Rock, on *Acacia acuminata, Gardner 12540* (holotype, PERTH).

Distribution. Reported throughout the range of the species.

Merrill (1916) used Thunberg's 1784 epithet "opuntia" for this taxon. Nomenclaturally, the combination *Korthalsella opuntia* (Thunberg) Merrill applies to *Viscum opuntioides* L. See discussion of *K. taenioides* f. *taenioides*, above.

5b. Korthalsella japonica (Thunberg) Engler f. **rubra** (Tieghem) Molvray, comb. et stat. nov. Basionym: *Bifaria rubra* Tieghem, Bull. Soc. Bot. France 43: 173. 1896. *Korthalsella rubra* (Tieghem) Engler, Nat. Pflanzenfam. Nachtr. 3. 138. 1897. TYPE: Australia. New South Wales, Richmond and Clarence Rivers, *Beckler s.n.* (holotype, P; isotype, MEL).

Distribution. Reported from northern Queensland, New South Wales, Himalaya, and Japan.

5c. Korthalsella japonica (Thunberg) Engler f. **grayi** (Barlow) Molvray, comb. et stat. nov. Basionym: *Korthalsella grayi* Barlow, Brunonia 6: 46. 1983. TYPE: Australia. North Queensland State Forest Reserve 607, Emerald Logging Area, 1100 m, on *Elaeocarpus ferrugineus, Gray 1724* (holotype, QRS).

Distribution. Reported from north Queensland, Australia.

6. Korthalsella lindsayi (Oliver ex J. D. Hooker) Engler, Nat. Pflanzenfam. Nachtr. 3. 138. 1897. *Viscum lindsayi* Oliver ex J. D. Hooker, Handb. N. Zeal. Fl. 108. 1867. TYPE: New Zealand. Middle Island [= South Island], Otago, *Lindsay s.n.* (AK, K).

Distribution. North and South Islands of New Zealand, and possibly Island Art, New Caledonia.

KEY TO THE VARIETIES OF *KORTHALSELLA LINDSAYI*

1a. Vegetative segments suborbicular, two or less times longer than broad . . . . . 6a. var. *lindsayi*

1b. Vegetative segments narrowly obovate, more than two times longer than broad . . . . . 6b. var. *clavata*

6a. Korthalsella lindsayi (Oliver ex J. D. Hooker) Engler var. **lindsayi**

Heterixia amentacea Tieghem, Bull. Soc. Bot. France 43: 178. 1896. *Korthalsella amentacea* (Tieghem) Engler, Nat. Pflanzenfam. Nachtr. 3. 138. 1897. TYPE: New Caledonia. Island Art, on *Baeckea virgata, Montrousier 201* (LY?).

Distribution. North and South Islands of New Zealand, and possibly Island Art, New Caledonia.

6b. Korthalsella lindsayi (Oliver ex J. D. Hooker) Engler var. **clavata** (T. Kirk) Danser, Bull. Jard. Bot. Buitenzorg 14: 130. 1937. *Viscum clavatum* T. Kirk, Trans. & Proc. New Zealand Inst. 24: 429. 1892. TYPE: New Zealand. South Island, Canterbury, Castle Hill Basin, 600–900 m, 1876, *Kirk & Enys s.n.* (AK).

Distribution. North and South Islands of New Zealand.

7. Korthalsella salicornioides (A. Cunningham) Tieghem, Bull. Soc. Bot. France 43: 164. 1896. *Viscum salicornioides* A. Cunningham, Ann. Nat. Hist. 2: 208. 1839. TYPE: New Zealand. North Island, Keri Keri River, on *Leptospermum scoparium*, 1833, *A. Cunningham s.n.* (G, P).

Korthalsella madagascarica Danser, Bull. Jard. Bot. Buitenzorg 14: 126. 1937. TYPE: Madagascar. W of Ambositra, on the right bank of the Ivato River, on *Diospyros, Perrier de la Bâthie 12363* (P).

Korthalsella striata Danser, Bull. Jard. Bot. Buitenzorg 14: 124. 1937. TYPE: New Caledonia. Isle of Pines on the central plateau, on *Baeckea, Pancher V.638* (P).

Distribution. North and South Islands of New Zealand, Isle of Pines south of New Caledonia, and Madagascar.

8. Korthalsella dacrydii (Ridley) Danser, Recueil Trav. Bot. Néerl. 31: 759. 1934. *Arceuthobium dacrydii* Ridley, J. Fed. Malay. States Mus. 6: 170. 1915. TYPE: Malay peninsula. Pahang, Gunong Tahan, 900–1500 m, on *Dacrydium, Ridley 16094* (holotype, K; isotypes, BM, SING).

Distribution. Malay peninsula and Java.

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New Species of Loranthaceae and Viscaceae for the "Forest Flora of Malawi"

R. M. Polhill
Herbarium, Royal Botanic Gardens, Kew, Richmond, Surrey TW9 3AE, U.K.

D. Wiens
Department of Biology, University of Utah, Salt Lake City, Utah 84112, U.S.A.

ABSTRACT. Four new species of Loranthaceae and three new species of Viscaceae are described, namely *Agelanthus bipartitus* Balle ex Polhill & Wiens, *A. pilosus* Polhill & Wiens, *Englerina cordata* Polhill & Wiens, and *Oedina congdoniana* Polhill & Wiens in Loranthaceae, and *Viscum congdonii* Polhill & Wiens, *V. cylindricum* Polhill & Wiens, and *V. loranthicola* Polhill & Wiens in Viscaceae. This paper is a precursor to an account in the "Forest Flora of Malawi."

Descriptions of seven new mistletoe species are presented here so that the names can be used in the forthcoming "Forest Flora of Malawi" by F. Dowsett-Lemaire, F. White, and J. D. Chapman. The authors are preparing an account of the "Mistletoes of Africa" to be published later in 1997. It will contain more information on the relationships of the species validated here. A general account of speciation patterns in African Loranthaceae, with an indication of the current generic arrangement, can be found in Polhill (1989) and a list of the published species of Loranthaceae and Viscaceae in tropical Africa is given in Polhill and Wiens (1992). Botanical subdivisions for countries mentioned in the specimen citations follow the conventions for local floristics, as shown, for example, in Polhill (1982: map 1).

LORANTHACEAE

Agelanthus bipartitus Balle ex Polhill & Wiens, sp. nov. TYPE: Tanzania. Njombe District, Madehani, 26 Jan. 1914 (fl), *Stolz 2475* (holotype, BR; isotypes, BM, K, P). Figure 1F–H.

Ab *Agelanthus elegantulo* (Engler) Polhill & Wiens ramulis mox prominenter lenticellatis, foliis breviter petiolatis ellipticis paucinervibus, petiolo 1–5 non 5–15 mm longo, foliis plerumque oblongo-ellipticis (nec lanceolatis nec ovato-ellipticis), calyce tubuloso circumscisso 3–5 mm longo (non cupulato longitudinaliter fisso 2–3 mm longo) differt.

Small shrub, spreading to 1 m; branchlets scurfy at tips but soon thickened, gray, glabrescent and prominently lenticellate. Leaves alternate; petiole 1–5 mm long; lamina thinly coriaceous, deep green, elliptic to oblong-elliptic, obtuse to rounded at apex, cuneate at base, 4–8 × 2–3 cm, few-nerved, the second pair ascending almost to apex (sometimes scarcely apparent). Umbels 1–several, sessile, 2–4-flowered; bract cupular, 2–3 mm long, slightly lacerate, sparsely ciliolate, sometimes with a small limb. Receptacle 2 mm; calyx tubular, 3–5 mm, shortly toothed, ciliate, circumscissile near base as corolla swells, the detached part persistent on the corolla tube. Corolla 3.2–4.2 cm, tube red, lobes yellow with darker red tip; apical swelling of bud slight, 5 mm; basal swelling globose-ellipsoid, 4 × 3–3.5 mm; lobes erect, 7–8 mm long, linear-elliptic to linear-oblanceolate in upper two-thirds to three-quarters. Filaments inflexed, orange-yellow, last 1 mm hardened, paler, thickened; tooth 0.2–0.3 mm; anthers 2.5 mm. Style slender, red, slightly expanded opposite filaments, narrowed to a neck 3 mm long; stigma capitate, 0.7–0.8 mm across. Berry not seen.

Montane forest, 1500–2250 m, in the Southern Highlands of Tanzania and the Nyika Plateau of northern Malawi, on various hosts, flowering January–August.

Allied to *Agelanthus elegantulus* (Engler) Polhill & Wiens (Fig. 1A–E), a species of the upland forests of Kenya and northern Tanzania. It is easily distinguished by the longer calyx split around the base by the expanding corolla base and retained as a dried ring around the narrow part of the corolla tube. In *A. elegantulus* the cupular calyx remains entire or more generally split down one side as the corolla base expands (Fig. 1C).

Paratypes. TANZANIA. **S:** 18 mi. SE of Tanzam highway on west loop road to Dabaga, SW of Iringa, 29 Jan. 1986 (fl), *Wiens & Frank* in *Wiens 6599* (BR, DSM, EA, K); Dabaga, 26 Feb. 1932 (fl), *Lynes 69 bis* (K); Mufindi, outside tea estate house on golf course, July 1982 (fl), *Congdon 4* (K); Mufindi, Lugoda tea estate factory, 11

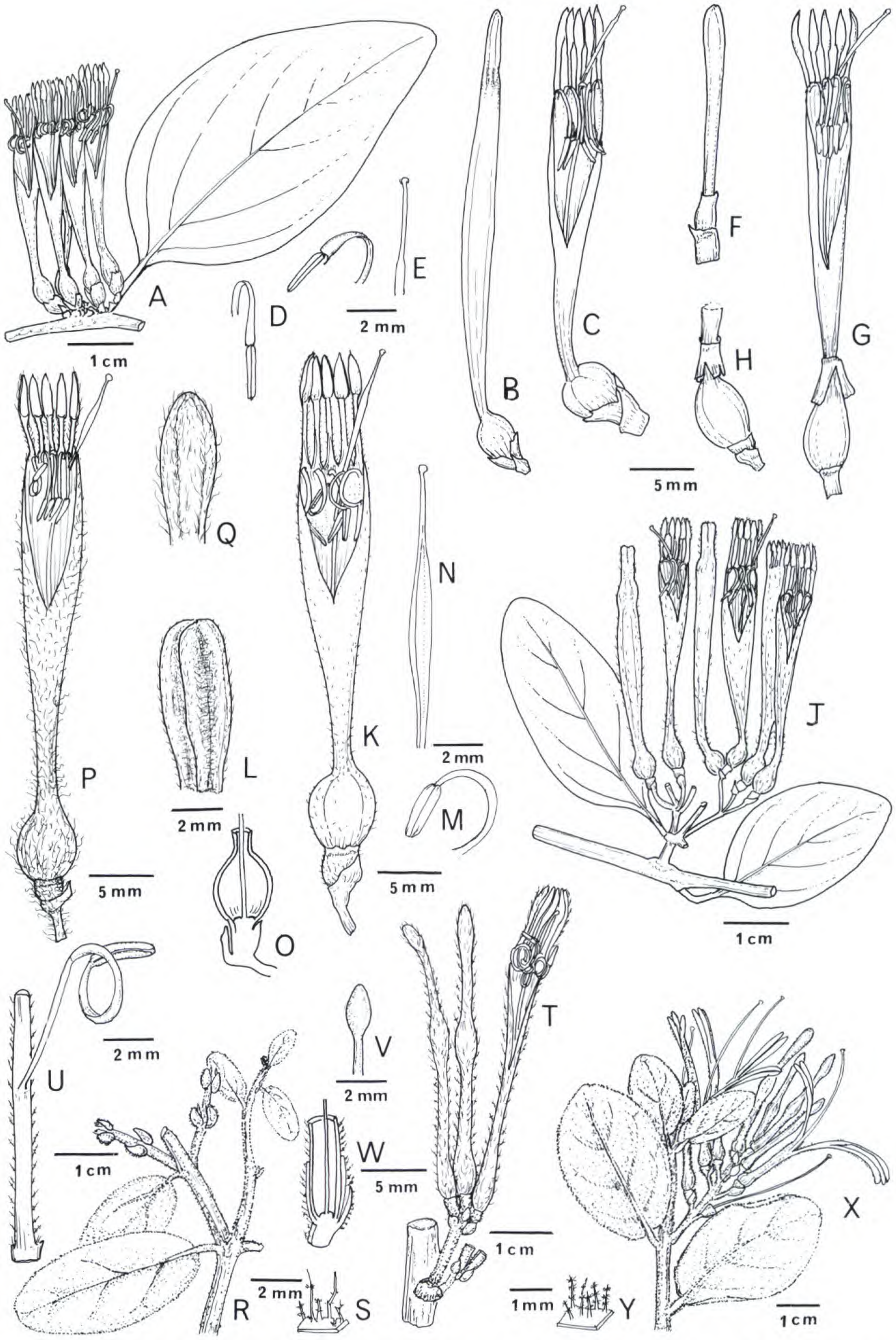

Figure 1. A–E: *Agelanthus elegantulus* (Engler) Polhill & Wiens. —A. Flowering node. —B. Mature bud. —C. Flower. —D. Stamen, two views. —E. Style tip. F–H: *Agelanthus bipartitus* Balle ex Polhill & Wiens. —F. Young flower bud. —G. Flower. —H. Base of flower. J–O: *Agelanthus scassellatii* (Chiovenda) Polhill & Wiens. —J. Flowering branch. —K. Flower. —M. Stamen. —N. Style tip. —O. Section of flower base. P, Q: *Agelanthus pilosus* Polhill & Wiens. —P. Flower. —Q. Tip of flower bud. R–W: *Oedina congdoniana* Polhill & Wiens. —R. Shoot with young inflorescence. —S. Hairs. —T. Flowering node. —U. Stamen. —V. Style tip. —W. Section of flower base. X, Y: *Oedina erecta* (Engler) Tieghem. —X. Flowering branch. —Y. Hairs. A, C: *Drummond & Hemsley 2806*; B: *Polhill 4979*; D, E: Polhill *4947*; F: *Stolz 2475*; G: *Bidgood & Keeley 285*; H: *Milne-Redhead & Taylor 11025*; J–O: *Bally & A. R. Smith 14938*; P, Q: *Feehan 57*; R: *Congdon 139*; S–W: *Brummitt et al. 16254*; X, Y: *Polhill et al. 4998*. Adapted and augmented from drawings prepared by Christine Grey-Wilson for the "Mistletoes of Africa."

May 1968 (fl), *Renvoize & Abdallah 2102* (K, P); Lugoda Estate, 3 May 1986 (fl), *R. M. & D. Polhill 5255* (BR, K); Kibao, 9 Jan. 1986 (fl), *C. Wiens, D. Wiens & Congdon* in *Wiens 6562* (BR, DSM, EA, K); Mufindi, Kidope road to Luhota dam, 18 Mar. 1986 (fl), *Bidgood & Keeley 285* (K, WAG); Lupembe Tea Estate, N of Mufindi, 23 Mar. 1972 (fl), *Wiens 4600* (K); Nyumbanyito, ca. 13 km NNW of Njombe, 9 July 1956 (fl), *Milne-Redhead & Taylor 11025* (B, BR, K, LISC); Rungwe, Kiwira River, Middle Fishing Camp, 26 Jan. 1963 (fl), *Richards 17622* (K). MALAWI. **N:** Nyika Plateau, Zovochipolo forest patches, Apr. 1981 (fl), *Dowsett-Lemaire 118* (K); Nyika Plateau, Juniper Forest, 12 Mar. 1985 (fl), *Bampton 6* (K); Nyika Plateau, juniper forest, 11 Aug. 1946 (fl), *Brass 17182* (BR, K, MO, SRGH, US); Nyika Plateau, below Sangule kopje, 7 km SW of Chelinda camp, 15 May 1970 (fl), *Brummitt 10760* (K, SRGH).

Agelanthus pilosus Polhill & Wiens, sp. nov. TYPE: Malawi, Ntchisi, 30 Oct. 1983, *Feehan 57* (holotype, K; isotypes, BR, MAL, MO, P, WAG). Figure 1P, Q.

Ab *Agelanthus scassellatii* (Chiovenda) Polhill & Wiens ramulis, foliis inflorescentibusque manifeste pilosis (non puberulis), apice alabastrorum oblongo-ovoideo vel obovoideo (non cristato), similiter lobis corollae non carinatis differt.

Spreading shrub up to 2 m, with relatively short lateral flowering branches bearing smaller leaves near their base; branchlets densely covered with very short and longer wispy hairs up to 2 mm long. Leaves mostly subopposite; petiole 5–15 mm; lamina green or gray-green, rather thin, ovate to ovate-lanceolate, pointed, ± slightly acuminate, basally rounded to slightly cordate, 2.5–11 × 1.2–6 cm, densely pubescent, glabrescent except on midrib beneath, with 1–2 pairs of principal lateral nerves strongly ascending from near the base. Umbels 8–16-flowered; peduncle and pedicels 2–3 mm long, densely pubescent; bract-limb ovate-triangular, 1–2 mm long. Receptacle 1.5–2 mm long, densely hairy; calyx 0.5–0.7 mm long, slightly toothed. Corolla 4–4.5 cm, yellow to orange with red tip, uniformly and conspicuously hairy with mostly fine spreading hairs; apex of bud oblong-ovoid to obovoid, 3.5–4 × 2.5 mm, ribbed; basal swelling ovoid-globose, 4–5 × 3.5–4 mm, with tube constricted above for 3–4 mm; lobes erect, 7–9 mm, upper expanded part lanceolate, 3.5–5 × 1 mm, hardened inside, slightly keeled outside. Stamens inflexed; tooth 0.5 mm; anthers 2–3 mm. Style with a neck 2–3 mm long; stigma capitate, 0.7–9 mm across. Berry red, obovoid, 10 × 7 mm, pubescent.

Known only from northern and central Malawi (Nyika, Viphya, Ntchisi, and Dedza) in montane and riverine forest or higher rainfall *Brachystegia* woodland nearby, 1150–1900 m, flowering prolifically in October and November, commonly on *Bridelia*, but also on various other forest margin and woodland species.

Agelanthus pilosus seems most closely related to a series of species along the coastal region of eastern and southern Africa, particularly *A. scassellatii* (Chiovenda) Polhill & Wiens (Fig. 1J–O), but markedly more hairy than any of these. It abuts the range of the common woodland species, *A. pungu* (De Wildeman) Polhill & Wiens, but is easily distinguished in Malawi by the hairiness, greener leaves, and less obviously and consistently shortened flowering branches, locally also by the keeled corolla lobes (*A. pungu* varies somewhat in this respect elsewhere).

Paratypes. MALAWI. **N:** Chelinda River, 1 mi. E of Rumphi, 6 Nov. 1977 (fl), *Pawek 13221* (BR, K, MO, SRGH, WAG); S Rukuru River, E of Njakwa bridge, 6 Dec. 1986 (fl), *E. A. S. & I. F. la Croix 898* (K, MAL); junction of road a few km below Thazima, 18 Mar. 1985 (fr), *Bampton 15* (K); near Encuweni, 2 Dec. 1985 (fl), *Bampton 62* (K); Kaningina Forest Reserve, ca. 5 km out of Mzuzu, 6 Dec. 1985 (fl), *E. A. S. & I. F. la Croix 740* (K); Mzuzu, 19 Mar. 1985 (fr), *Bampton 18* (K); Mzuzu, 2 Dec. 1985 (fl bud), *Bampton 63* (K); Mzuzu, just past roundabout on Nkhata Bay road, 6 Dec. 1985 (fl), *E. A. S. & I. F. la Croix 739* (K); S Viphya, near Lwafwa drift, 10 Dec. 1985 (fl), *I. F. la Croix 744* (K); Viphya, Luwawa, 29 Sep. 1985 (fl), *Bampton 55* (K); 3 km S of Chikangawa, 23 Oct. 1978 (fl), *E. Phillips 4130* (K, MAL, MO, WAG); Chikangawa–Nthungwa road, 8 Nov. 1968 (fl), *Salubeni 1217* (K, MAL, SRGH); Mzimba River bridge, 20 Mar. 1985 (fr), *Bampton 25* (K); 11 mi. E of Mzimba, 13 Nov. 1977 (fl), *E. Phillips 3069* (K, MO, SRGH); Nkhata Bay, *E. Phillips 4214B* (MAL); between boma and Ntchisi Forest, 31 Oct. 1982 (fl), *Feehan 17* (K); Ntchisi, Nov. 1982 (fl), *Feehan 70* (K); Mchinji, Ludzi Mission road, 23 Nov. 1983 (fl), *Salubeni & Patel 3536* (K, MAL); Dedza, Chiwao Hill, 21 Nov. 1966 (fl), *Salubeni 464* (K, MAL, SRGH); Kachere, *G. Jackson 2252* (MAL); Ntcheu, *Patel & Tawaka 4149* (MAL).

Englerina cordata Polhill & Wiens, sp. nov. TYPE: Malawi. Nyika National Park, Chisanga Falls, 17 July 1984 (fl bud & fr), *Feehan 100* (holotype, K; isotypes, BR, DBN, K, LISC, MAL, MO, SRGH).

Ab *Englerina inaequilatera* (Engler) Polhill & Wiens foliis sessilibus cordatis heteromorphis ramulorum basin versus brevioribus latioribusque (non subaequaliter lineari-lanceolatis, lanceolatis vel ovatis petiolatis basi cuneatis vel rotundatis), tubo corollae intus minute papillato (non manifeste papilloso) facile distinguitur.

Small glabrous shrub with mostly rather short spreading flowering branchlets; twigs slightly compressed. Leaves sessile, thin, glaucous, purple-flushed above when young, mostly lanceolate to ovate, acuminate, basally cordate, 3–5 × 1–2 cm, with ± 6 pairs of lateral nerves (lower ones slightly

more ascending), but leaves toward base of flowering branchlets progressively smaller, blunter and rounded to oblate. Flowers 4–6 per umbel; peduncle 2–3 mm long; pedicels 3–4 mm long; bract acuminately triangular from a shallow cup, 2–3 mm long, ciliolate at tip. Receptacle 1–1.5 mm long, glaucous; calyx 0.3–0.4 mm long, minutely ciliolate. Corolla buds 2.5–2.7 cm, reddish with darker tip, a little swollen in lower part, tapered to vents 11 mm from base, then narrow to a slight oblong-ellipsoid apical swelling 5–6 mm long, slightly apiculate; tube with very small scattered papillae inside, most numerous basally and along sutures; open flowers not seen, but lobes presumably erect. Stamen filaments 10–11 mm; tooth subulate, 1.8 mm; anthers 3 mm. Berry obovoid, 6 × 5 mm, white below, pink above; seed white.

Known only from riverine forest near Chisanga Falls on the Nyika Plateau of northern Malawi, on *Garcinia* and *Rapanea*, in bud in July, fruit in April, and from two sites in southwestern Tanzania.

Closely allied to *Englerina inaequilatera* (Engler) Gilli, a polymorphic species very common along the flanks of Lake Malawi (see map in Polhill, 1989: 222, fig. 2) as far south as Dedza, extending to easternmost Zambia, to the Serra Macuta in Mozambique and northward in Tanzania to the Usambara Mts. Despite the very considerable variation in that species, *E. cordata* seems from field inspection clearly distinguishable by the shape of its leaves and warranting specific rank on present evidence.

Paratypes. TANZANIA. **W:** Ufipa, Mbizi Forest Reserve, Nsonta, *Ruffo & Kisena 2790* (K). **S:** 33 km SW of Lupende tea estate on Njombe–Manda road, *Wiens & Spurrier 7006* (EA). MALAWI. **N:** Nyika National Park, Chisanga Falls, 28 Apr. 1986 (fr), *R. M. & D. Polhill 5253* (K).

Oedina congdoniana Polhill & Wiens, sp. nov. TYPE: Malawi. Mafinga Mts., 2 Mar. 1982 (fl), *Brummitt, Polhill & Banda 16254* (holotype, K; isotypes, BR, MAL, MO). Figure 1R–W.

Ab *Oedina erecta* (Engler) Tieghem floribus sessilibus (non 0.5–1 mm pedicellatis), longioribus, corolla 4–4.5 non 2.5–3 cm longa, hirsutis (non tomentellis), in spicis abbreviatis (non racemis 2–5 cm longis) dispositis facile distinguitur.

Shrub, spreading, well branched, to 1 m or so; twigs rusty tomentose with short dendritic hairs. Petiole 2–5 mm; lamina thinly coriaceous, reddish green above, oblong-elliptic to oblong-obovate, rounded at apex, shortly cordate at base, 3–6 × 2–3 cm, rusty tomentellous beneath; lateral nerves 6–8 pairs, sometimes obscure. Spikes axillary and at older nodes, with 4–6 paired flowers on an axis 7–15 mm long; bract ovate to obovate, concave, 2.5–4 mm long. Receptacle 3 mm long, hirsute; calyx tubular, 3–4 mm long, ciliate. Corolla 4–4.5 cm long, dull yellow beneath covering of rusty hairs, with band of red at slits in late bud; hairs mostly subsimple, 2–3 mm long; bud tip scarcely swollen; tube 16–19 mm long, with a short V-slit, the lobes ± coherent opposite; basal swelling slight; lobes erect to weakly spreading, linear, upper part only slightly expanded. Filaments pale yellow, inserted ± 6 mm above base of lobes, articulate ± two-thirds way up, upper part slightly thickened, coiled at anthesis and tending to break off; anthers 2.5 mm; connective-appendage minute. Berry not seen.

Montane forest, 1800–2200 m, in southern and southeastern Tanzania and northern Malawi.

This is a remarkable plant, one of the relictual species of the early radiation of one of the major evolutionary lines of African Loranthaceae. It has been collected from very few sites in northernmost Malawi and southern Tanzania. It is most similar to *Oedina erecta* (Engler) Tieghem (Fig. 1X, Y), which is restricted to a small area of dry montane forest in the W Usambara Mts. of northeastern Tanzania, but significantly different in its short spikes of flowers, rather than racemes with 6–14 flowers on a rhachis 2–5 cm long and pedicels 0.5–1(–2 in fruit) mm long, by the tubular rather than saucer-shaped calyx, the longer corolla hairs and longer corolla tube (only 8–10 mm in *O. erecta*). The corolla lobes are more coherent to one side, emulating the V-shaped slit common in more advanced genera of African Loranthaceae.

Named in honor of Colin Congdon, who collected this species on the eastern side of Lake Malawi in southern Tanzania at Manda, and who has provided logistical support and enthusiatic participation in the work of botanical collectors in southern Tanzania over the last 30 years. He has taken a special interest in the present project and found a number of new species.

Paratypes. TANZANIA. **S:** Uzungwa Mts., forest block to E of Udekwa village, W of Kilombero Forest Reserve, Dec. 1981 (fl bud), *Rodgers & Hall 2309* (K); West Kilombero Forest Reserve, W of Ruipa River, Oct. 1982 (fl bud), *Rodgers & Hall 2309A* (K); Njombe, 16 Dec. 1931 (fl bud), *Lynes F.j.28c* (K); Manda, 11 Jan 1987 (fl bud), *Congdon 139* (K).

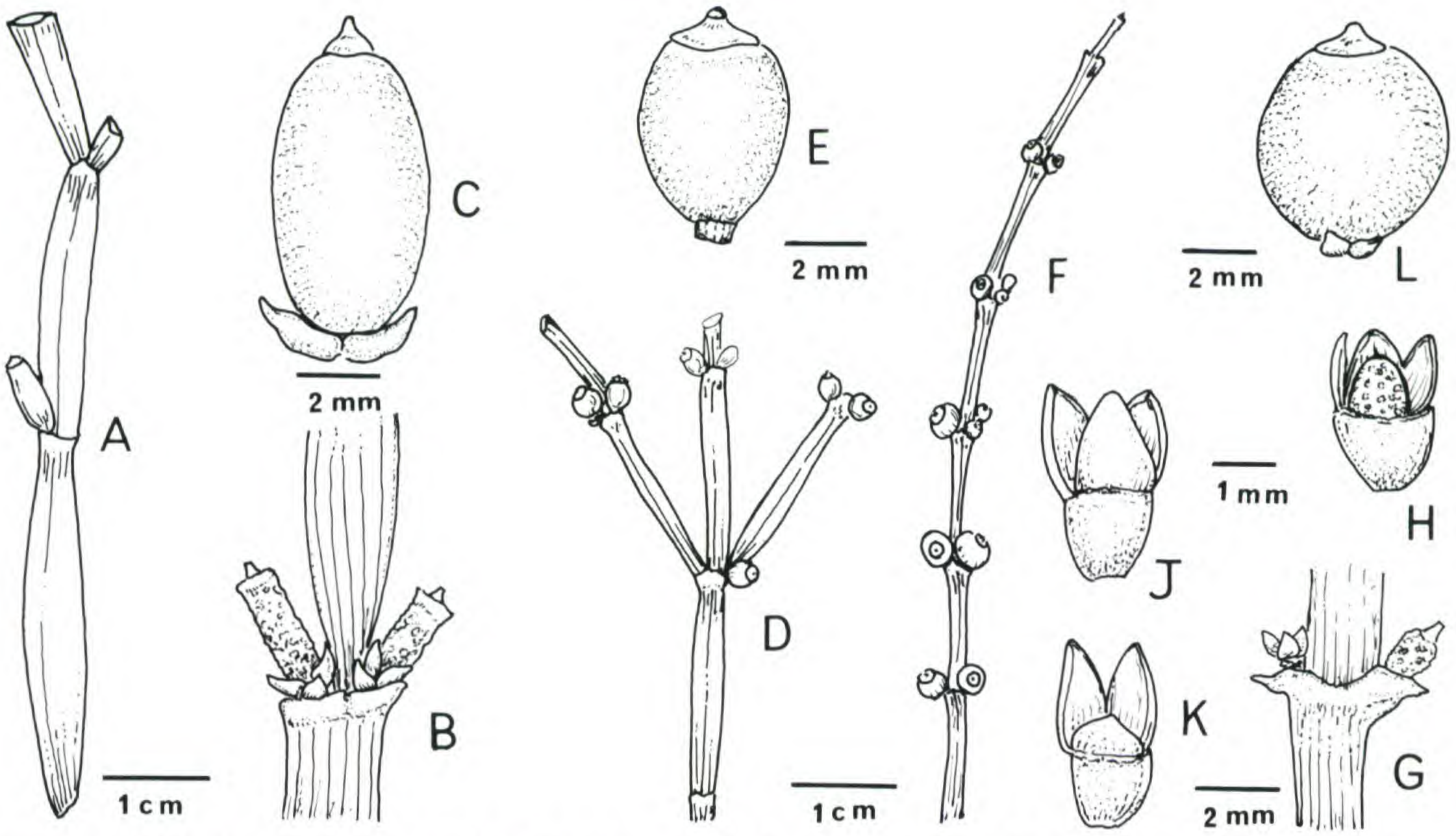

Figure 2. A–C: *Viscum cylindricum* Polhill & Wiens. —A. Fruiting stem. —B. Node with young fruits. —C. Fruit. D, E: *Viscum congdonii* Polhill & Wiens. —D. Fruiting stem. —E. Fruit. F–L: *Viscum loranthicola* Polhill & Wiens. —F. Fruiting stem. —G. Fertile node. —H. Male flower, one tepal removed. —J. Female flower. —K. Same, one tepal removed. —L. Fruit. A–C: *E. Phillips 4341*; D, E: *Wiens 6985*; F: *Wiens 6552*; G–K: *Polhill 5251*; L: *Philcox et al. 9905*. Adapted and augmented from drawings prepared by Christine Grey-Wilson for the "Mistletoes of Africa."

VISCACEAE

Viscum congdonii Polhill & Wiens, sp. nov. TYPE: Tanzania. Njombe District, eastern end of Kitulo Plateau, NW flank of Mtorwi Mt., near stream, 25 Sep. 1988, *Wiens, Congdon & Calvin* in *Wiens* 6985 (holotype, K; isotypes, BR, DSM, EA, MO, SRGH). Figure 2D, E.

A *Viscum goetzei* Engler habitu robustiore pendulo, caulibus usque 2 m longis (non erectis solum usque 50 cm), fructibus majoribus, 4 non 3 mm longis, stigmate sessili (non stylo manifesto 0.5 mm longo) differt.

Leafless, dioecious, relatively large, but delicate shrubs, older plants forming long pendulous masses to 2 m; internodes of distal branches flattened and narrowed 20–30 × 1–2 mm. Bracteal cups sessile, short (< 1 mm), often obscured by the subtending leaf-scales. Staminate flowers mostly borne singly, occasionally in dyads or triads, sessile. Pistillate flowers borne singly. Style not evident; stigma somewhat expanded at the summit of the ovary that is gradually elevated from the margin of the tepalar scars. Berries pedicellate (1 mm), ellipsoid, 4 mm high, smooth, orange. Tepalar ring-scars 2 mm diam. N = 14.

High-elevation evergreen forests (> 1500 m) and adjacent woodland in southern Tanzania, Malawi, and eastern Zimbabwe. Parasitic on *Toddalia* at the type locality. Flowering probably continuous.

The species shows close but superficial similarities to *Viscum goetzei*, with which it is associated at the type locality. *Viscum goetzei*, however, is an obligate epiparasite known only on *Englerina* (Loranthaceae). *Viscum goetzei* is a relatively small erect plant, < 0.5 m high, whereas *V. congdonii* is a large, pendulous plant up to 2 m long at maturity. The berries also differ in size, shape, style, and stigma characteristics, *V. goetzei* with ovoid berries bearing a small distinct style and capitate stigma.

The collections (mostly sterile) from the high-altitude forests of Malawi and Zimbabwe are provisionally placed here, but their classification as *Viscum congdonii* is not certain.

Paratypes. TANZANIA. **S:** Kitulo Plateau, northwestern flank of Mtorwi Mt., 25 Sep. 1988, *Wiens, Calvin & Congdon* in *Wiens 6987* (K). MALAWI. **N:** 5 mi. W of Chelinda, 3 Aug. 1976 (fl), *Wiens 5448* (PRE); Viphya Plateau, road to Chikangawa, N of Mzimba River, 3 Apr. 1984 (sterile), *I. F. la Croix 581* (K). **C:** Ntchisi Forest Reserve, above rest house, 27 Mar. 1970 (sterile), *Brummitt 9442* (K); Ntchisi Mt., near summit, 7 Mar. 1982 (fr), *Brummitt, Polhill & Banda 16367* (K). **S:** Mulanje, Esperanza Estate, 22 Oct. 1985 (sterile), *Chapman 6674* (FHO). ZIMBABWE. **E:** Banti North, 3 Oct. 1962 (fl), *Chase 7816* (K, SRGH); Banti South, 21 Mar. 1969 (fl), *Jacobsen 3872* (K, SRGH).

Viscum cylindricum Polhill & Wiens, sp. nov. TYPE: Malawi, 81 km [51 mi.] SW of Mzuzu on road to Mzimba, 15 Feb. 1986 (yng. fr), *Wiens & Frank* in *Wiens 6619* (holotype, K; isotypes, BR, MAL, MO). Figure 2A–C.

A *Viscum combreticola* Engler floribus masculinis singularibus (non ternatis), fructibus maturis oblongis (non rotundo-ellipsoideis) differt.

Leafless, dioecious, often large pendulous shrubs 1–2 m long; internodes of distal branches strongly flattened, 20–35 × 2–4 mm. Bracteal cups sessile in both sexes. Staminate and pistillate flowers sessile and borne singly. Style indistinct; stigma capitate at the summit of the ovary that is gradually elevated from the margin of the tepalar scars. Berries (when near maturity) sessile, oblong, 7 × 3.5 mm. Tepalar ring-scars 2 mm diam.

Higher-rainfall *Brachystegia* woodland and upland forest, 1500–2200 m, around Lake Malawi as far south as Mt. Mulanje, on various hosts including *Brachystegia, Croton,* and *Ochna.* Flowering period unknown (not March).

The species is vegetatively similar to *Viscum combreticola* Engler and *V. shirense* Sprague, but is readily distinguished from each by the cylindrical fruits and the rounded staminate flowers, which occur singly in the bracteal cup. Vegetatively *V. cylindricum* has somewhat longer and wider internodes than *V. shirense,* and narrower internodes than *V. combreticola.*

Paratypes. TANZANIA. **SE:** Mbinga, Kigonsera Mt., 27 Feb. 1987 (sterile), *Congdon 146* (K); Mbinga, Kiteza Forest Reserve, 1 Mar. 1987 (sterile), *Congdon 148* (K). MALAWI. **N:** Nyika Plateau, ca. 7 km W of Chelinda, 27 Mar. 1972 (fl bud), *Wiens 4614* (K); 9.5 km [6 mi.] E of Chelinda, 3 Aug. 1976, *Wiens 5449* (K, PRE); Nyika National Park, 4 mi. W of Livingstonia junction, Nya Mkowa (Nyamakhowa), 23 Feb. 1978 (yng. fr), *Pawek 13846* (K); N Viphya, Uzumara Forest, 6 Jan. 1987 (sterile), *E. A. S. & I. F. la Croix 4271* (K); 11 km [7 mi.] NW of Chikangawa, 3 Dec. 1978 (fr), *E. Phillips 4341* (K, MO). **C:** 142 km [89 mi.] Kasungu to Mzimba, Aug. 1976 (fl, fr), *Wiens 5440* (PRE); Ntchisi Mt., 26 July 1946 (male fl), *Brass 16967* (K); Ntchisi Mt., 26 July 1946 (fr), *Brass 16968* (K, SRGH); Ntchisi Mt., NE end, 11 July 1978 (male fl), *Iwarsson & Ryding 922* (K). **S:** Mulanje Mt., Likhubula River above Forestry Office, 17 June 1979 (fl bud), *Blackmore 864* (K, MAL); Mulanje, Mchese Mt., spur between Namyo and Namiziwa streams, 16 Apr. 1958 (fl bud), *Chapman H/661* (K, SRGH).

Viscum loranthicola Polhill & Wiens, sp. nov. TYPE: Tanzania. Iringa District, 29 km [18 mi.] N of Mafinga on road to Madibira, 7 Jan. 1986 (fl, fr), *C. & D. Wiens* in *Wiens 6552* (holotype, K; isotypes, DSM, UT). Figure 2F–L.

A *Viscum tenui* Engler plantis monoeciis, staminibus in synandrium connatis (non discretis), stigmate sessili (sine stylo 0.5 mm longo) bene distincta, necnon a *V. bagshawei* Rendle habitu minore, caulibus 10–30 cm erectis (non saepe plus quam 1 m pendulis), fructibus minoribus 3 non 5 mm longis, differt.

Leafless, monoecious, relatively small, ± 0.1–0.3 m high, erect, densely branched shrubs; internodes of distal branches 10–15 × 1–2 mm, rounded to slightly compressed on youngest growth. Bracteal cups sessile. Staminate and pistillate flowers 2 mm long, borne singly and subsessile. Staminate flowers with the anthers forming a central synandrium, the tepals often yellow, the staminate flowers often uncommon or rare (< 10%). Style indistinct; stigma a rounded prominence emerging from the summit of the fruit. Berries sessile, rotund, 3 mm high, smooth, orange. Tepalar ring-scars 2 mm diam.

Southern Tanzania, northern Malawi, northern and western Zambia, in *Brachystegia* or less commonly *Acacia* woodland. Parasitic only on genera of Loranthaceae (*Englerina, Erianthemum, Globimetula, Phragmanthera, Plicosepalus,* and *Tapinanthus*). Flowering probably continuous.

Virtually nothing is known of the life history of obligate epiparasitic species such as *Viscum loranthicola,* and it would make a fascinating subject for future study. The species appears related to *V. bagshawei* and another undescribed species from the Iringa region of southern Tanzania, both of which parasitize *Acacia* almost exclusively. *Viscum loranthicola* is biologically distinct by the epiparasitic habit and morphologically by the smaller stems and fruit. Kuijt et al. (1979) discussed the evolution of the synandrium in *V. bagshawei* (referred to in the paper as *V. sp. aff. hildebrandtii*). The occurrence of a synandrium, unique to these two African species, coupled with an epiparasitic habit, rank *V. loranthicola* as a highly advanced species of the genus.

Paratypes. TANZANIA. **W:** near Tatanda mission, ca. 25 km from Zambian border S of Sumbawanga, 22 June 1986 (fr), *J. & J. Lovett & Howell 834* (K, MO). **S:** Madibira–Mafinga road, hills between Madibira and Igoma, 10 Jan. 1988 (fl), *Congdon 187* (K); 30 km W of Mafinga on the Madibira road, Penns Farm, by Ndembera River, 23 Feb. 1986 (yng. fr), *J. & J. Lovett, Congdon & Bidgood 540* (K, MO); 35 km [21.7 mi.] N of Mafinga on Madibira road at village, 7 Jan. 1986 (fr), *C. & D. Wiens* in *Wiens 6555* (DSM, EA, K, MO); 49 km [30.5 mi.] N of Mafinga on Madibira road, 7 Jan. 1986 (fr), *C. & D. Wiens* in *Wiens 6556* (K, UT) & 7 Jan. 1986 (fl), *C. & D. Wiens* in *Wiens 6558* (DSM, K, MO, UT); 33 km [20.8 mi.] N of Mafinga on Madibira road, 28 Sep. 1988 (fr), *Wiens & Calvin* in *Wiens 6990* (K, UT); Mbeya, ca. 1 km [half a mile] W of Referral Hospital, 16 Jan. 1986 (fr), *C. & D. Wiens* in

Wiens 6573 (K, UT); road between Songea and Njombe, Dabaga village, 4 Feb. 1986 (fr), *Congdon* in *Wiens 6606* (BR, DSM, EA, K). MALAWI. **N:** Nyika National Park, 16 km [10 mi.] E of barrier, 1 Mar. 1976 (fr), *E. Phillips 1338* (K, MO, SRGH); 57.5 km [36 mi.] SW of Chelinda, 3 Aug. 1976 (fl, fr), *Wiens 5453* (K, PRE); Rumphi–Chisenga road, half a km S of Nyika road junction, 15 Mar. 1972 (fl, fr), *Wiens 4607* (K); 11 km on M1 from junction with M12 on Viphya scarp N of Mzimba, 25 Apr. 1986 (fl, fr), *R. M. & D. Polhill 5251* (K); 8 km[5 mi.] S of Mzimba, 16 Feb. 1986 (fl, fr), *Wiens & Frank* in *Wiens 6623* (K, MO, UT). ZAMBIA. **N:** Chinsali, Rest House, 13 Apr. 1986 (fr), *Philcox, Pope & Chisumpa 9905* (K); ca. 73 km S of Kitwe, 23 Feb. 1986 (fr), *Wiens, Frank & Millar* in *Wiens 6629* (K, MO, NDO, SRGH). **C:** Serenje Corner, 16 July 1930 (fr), *Hutchinson & Gillett 3715* (K, SRGH); Serenje, Rest House, 11 Apr. 1986 (yng. fr), *Philcox, Pope & Chisumpa 9837* (K).

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A New Species of *Solenophora* (Gesneriaceae) from Southeast Veracruz, Mexico

Angélica Ramírez-Roa and Guillermo Ibarra-Manríquez***

*Departamento de Botánica, Instituto de Biología, Universidad Nacional Autónoma de México, Apartado Postal 70-233, Deleg. Coyoacán, 04510 México, D.F., Mexico.

**Dirección actual: Departamento de Ecología de los Recursos Naturales, Instituto de Ecología, Universidad Nacional Autónoma de México, Apartado Postal 27-3, Xangari 58089, Morelia, Michoacán, Mexico

RESUMEN. Se describe e ilustra *Solenophora tuxtlensis* (Gesneriaceae, Gesnerioideae), una nueva especie de Veracruz, México. Las características más evidentes para distinguir esta especie son el cáliz muy largo y tubular, la corola con máculas púrpuras en los lóbulos y una glándula nectarífera bilobulada. *Solenophora tuxtlensis* es conocida solamente de la región de Los Tuxtlas, Veracruz.

ABSTRACT. *Solenophora tuxtlensis* (Gesneriaceae, Gesnerioideae), a new species from Veracruz, Mexico, is described and illustrated. The most prominent features distinguishing this species are the long tubular calyx, and the corolla with dark purple spots on the lobes and only one bilobed nectariferous disc gland. It is known only from the Los Tuxtlas region, Veracruz.

Solenophora Bentham is a neotropical genus in the tribe Gloxinieae (Fritsch) Wiehler (Wiehler, 1983), and has about 15 species occurring from Mexico to Panama (Gibson, 1974; Skog, 1979). Similar to other genera in the family, this genus is poorly collected in Mexico and needs to be revised. About six species in the genus have been collected in Mexico in the states of Chiapas, Oaxaca, Puebla, and Veracruz.

During preparation of a floristic study of the "Los Tuxtlas" Biological Station in Veracruz, Ibarra-Manríquez and Sinaca (1987) collected material of *Solenophora* that corresponded to specimens provisionally named as *Solenophora* "tuxtla" by Dale Denham. An examination of herbarium material from MEXU and US and the literature about this genus revealed to us that the Denham species is worthy of publication.

Solenophora tuxtlensis Ramírez-Roa & Ibarra-Manríquez, sp. nov. TYPE: México. Veracruz: Mpio. San Andrés Tuxtla, Estación de Biología Tropical Los Tuxtlas, Lote 71, 18°34′–36′N, 95°05′–09′W, 400 m, 18 ene. 1991, *G. Ibarra & S. Sinaca 3533* (holotype, MEXU; isotypes, BM, ENCB, F, K, LE, MO, US, XAL). Figure 1.

Planta terrestris suffrutescens vel frutex erectus, ramosus; caulis pilosus, folia opposita longipetiolata, herbacea, laxe, pilosa, lamina elliptica; petioli axillari 1–2; calyx 2.6–4.1 cm longus, subcampanulatus flavescens, limbus breviter 5-lobatus, lobi deltoidei serrati; corolla cylindrica, flava, tubus intus purpureo-maculatus, lobi purpureo-maculati; stamina epicorollina, antherae apice connatae; stigma stomatomorphum; ovarium inferum pilosum; discus e glandula bilobata formatus; capsula calyce accrescenti; semina elliptica.

Suffrutescent herbs or shrubs 1.5–2.5 m tall; internodes pubescent, trichomes multicellular, 0.5–1 mm long, more conspicuous in younger parts. Leaves opposite, simple, elliptic, rarely narrowly elliptic or ovate, 3.5–25 × 1.8–14 cm, 1.5–3 times longer than wide, the base oblique, the apex acute or cuspidate, biserrate, membranous, upper surface dark green, pilose, trichomes 1–2 mm long, lower surface light green or frequently reddish, pilose along the costa and secondary veins, 6–9 secondary veins, pinnate; petiole 1.5–13 cm long, sparsely pilose, reddish above. Peduncle reddish, 2.5–7 cm long, pilose; bracts 2, linear, 0.4–1.2 cm long, green, pilose. Flowers showy, 1–2 in each axil; floral tube turbinate, 6–9 × 3–6 mm, red at the base, yellowish at the apex; calyx erect, slightly campanulate, 2.6–4.1 cm long, yellow; tube 1.5–3.3 × 0.8–1.5 cm, reddish tomentose; 5 lobes triangular, 2–8 × 2–8 mm long and wide, margin serrate and pubescent, trichomes ca. 1 mm long; corolla tubular, slightly broader toward the apex, 4.3–6 cm long, yellow, with dark purple spots on the lobes, the spots becoming lines toward inside of the tube; tube of the corolla 3.5–5 cm long, 0.7–1 cm broad at the base, bisacciform dorsally, 1.3–1.6 cm at the throat, the limb 5-lobed, 0.8–1 cm long × 7–8 mm wide, margin fimbriate; 4 stamens diadelphous, included, adnate to the base of the corolla tube, 4.4–4.6 cm long, glabrous, anthers broadly ovate, coherent in a square, each 2–4 mm wide, longitudinally dehiscent, the connective glabrous, staminode ca. 5 mm long, pollen tricolpate, colpi 24–29 μm

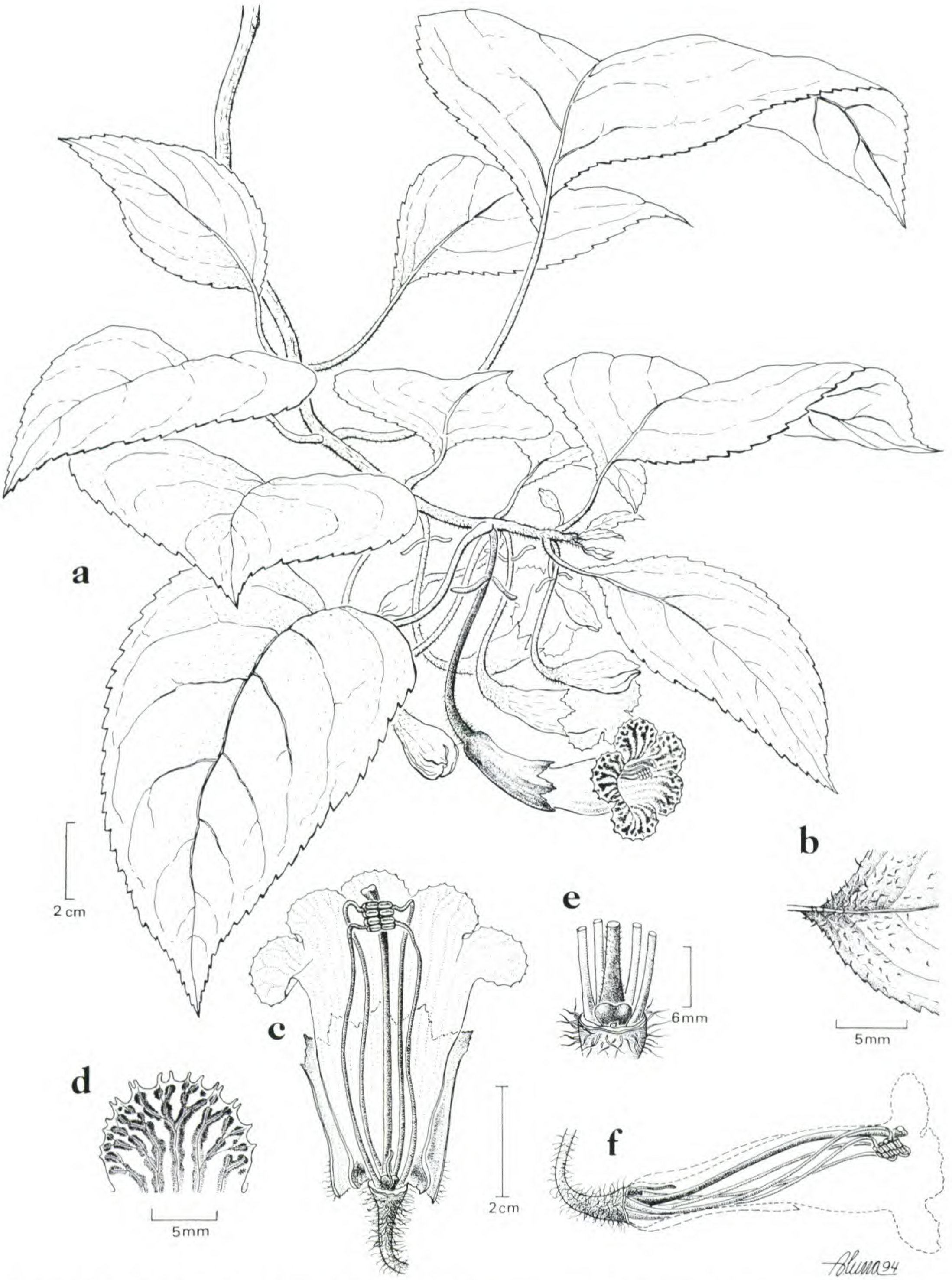

Figure 1. *Solenophora tuxtlensis* Ramírez-Roa & Ibarra-Manríquez. —a. Habit showing flowers. —b. Leaf blade base, abaxial surface. —c. Flower opened, showing diadelphous stamens, staminode, disc gland, style, and stigma. —d. Close-up of petal lobe with fimbriate margin. —e. Close-up of bilobed disc gland (staminode removed). —f. Flower, lateral view (calyx and corolla removed). Based on *Ibarra & Sinaca 3533*, MEXU.

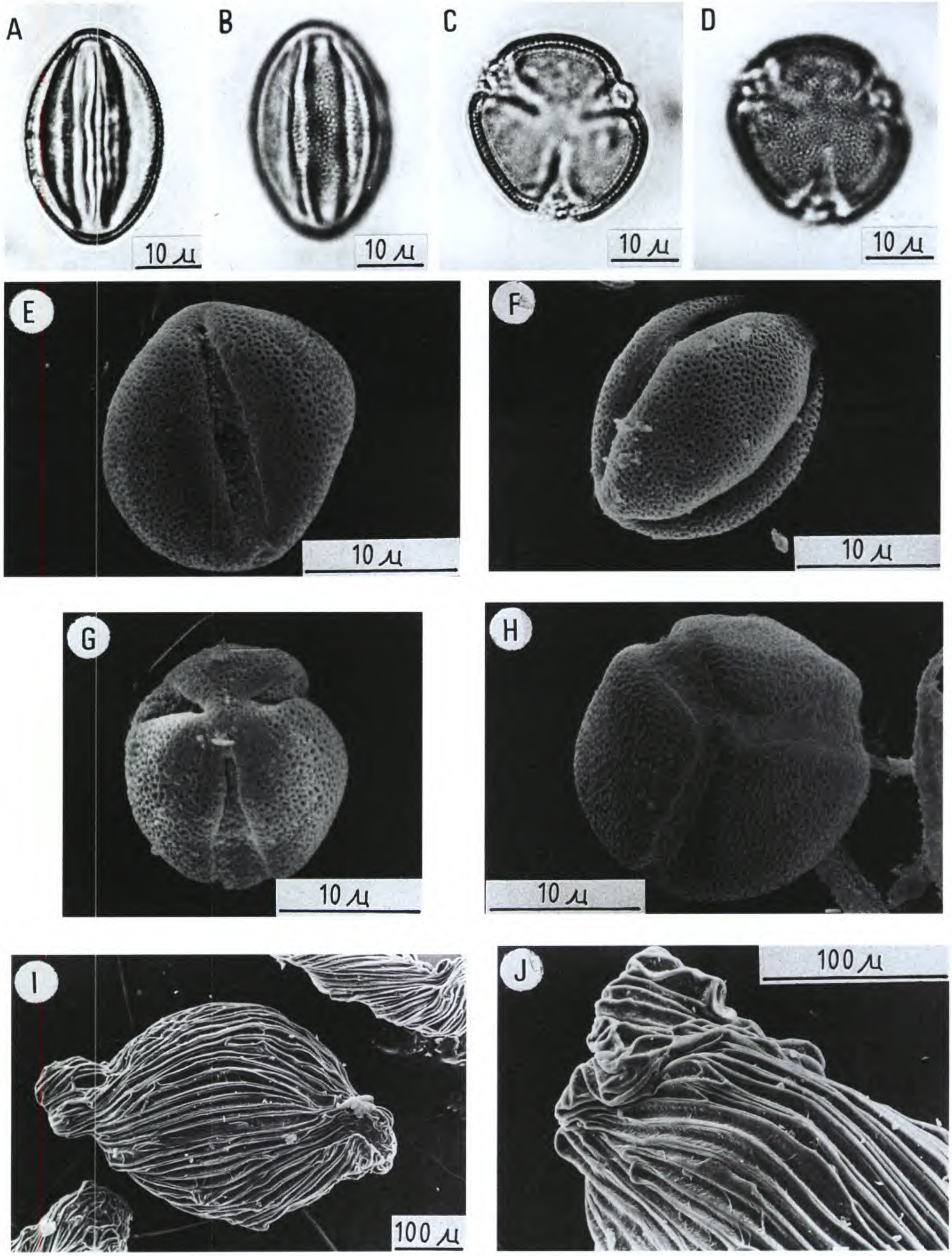

Figure 2. A–H. Pollen of *Solenophora tuxtlensis* Ramírez-Roa & Ibarra-Manríquez. A–D. Light microscope photomicrographs of pollen (based on *Ibarra & Sinaca 3533*, MEXU). (Scale 1 cm = 10 µm). —A. Meridional view. —B. Meridional view. —C. Polar view. —D. Polar view. E–H. SEM photomicrographs of pollen (based on *Ibarra & Sinaca 3533*, MEXU). —E. Meridional view showing colpus. —F. Meridional view showing two colpi. —G. Polar view. —H. Close-up of mesocolpium and three colpi. I, J. Photomicrographs of *S. tuxtlensis* seed (based on *Ibarra & Sinaca 3533*, MEXU). —I. Longitudinal view of seed showing shape, apex, and ornamentation. —J. Epidermal cells of testa on face and apex (description in the text follows Beaufort-Murphy, 1983).

long, sometimes syncolpate, margins distinct, displaying persistent micro-verrucate colpus membrane (in SEM), exine semi-tectate, 1–1.5 μm thick, sexine micro-reticulate, heterobrochate, lumina < 1 μm, diminishing gradually toward poles and apertures (SEM), sexine/nexine ratio 2:1, prolate, polar axis 26–34 μm, equatorial axis 17–28 μm (Fig. 2A–H); nectariferous disc of 1 dorsal gland bilobed; ovary inferior, apex slightly convex, pilose to tomentose at the apex, reddish, rarely oblong, style terete, 4.5–5.5 cm long, pilose, stigma stomatomorphic, with glandular trichomes. Dry capsule surrounded by the accrescent calyx, 0.8–1.8 × 0.4–0.7 cm, turbinate, reddish tomentose; seeds numerous, ca. 5 mm long, elliptic, dark brown, apex constricted, cell shape narrowly lineate-polygonate, with edges elevated, crests discrete, face depressed, edges and faces verrucate (Fig. 2I, J). Chromosome number $n = 10$ (Skog, 1984).

Distribution and habitat. The new species is an uncommon plant known only from three municipal areas of Veracruz, Mexico: San Andrés Tuxtla, Catemaco, and Soteapan. It grows on rocks in small rivers, in primary tropical rainforest or cloud forest, at 200–950 m s.n.m.

Reproduction. Flowering is mainly from January to May, fruiting from March to June. Hummingbirds were seen visiting the flowers.

The epithet "tuxtla" suggested by Denham was written on herbarium specimens and labels of living collections. We have changed it to *tuxtlensis* following the Code (Recommendation 60 D.1., Greuter et al., 1994).

Paratypes. MEXICO. **Veracruz:** Municipio Catemaco, entre ejidos Adolfo Ruiz Cortínez y La Perla del San Martín, ca. 15 km al N de Catemaco, 18°31′N, 95°05′W, 950 m, 21 feb. 1972 (fr), *Beaman 5760* (MEXU, US); al N de un poblado a 10 km al SE de Tebanca camino al Bastonal, 19 dic. 1984, *Cedillo 2950* (MEXU); Municipio San Andrés Tuxtla, Estación de Biología Tropical Los Tuxtlas, Lote 71, 18°34′–36′N, 95°05′–09′W, 550 m, 17 feb. 1986 (fl, fr), *Ibarra & Sinaca 2824* (MEXU), 600 m, 1 ago. 1986 (fl, fr), *Ibarra et al. 2975* (MEXU, US); Volcán San Martín Tuxtla, "El Paraje" at edge of small stream, 1500 m, 18 Feb. 1962 (fl), *MacDougall 492* (US); Municipio San Andrés Tuxtla, Estación de Biología Tropical Los Tuxtlas, Lote 71, 18°34′–36′N, 95°05′–09′W, 600 m, 2 abr. 1986 (fl, fr), *Sinaca et al. 521* (MEXU, US); Laguna Azul, 200 m, 20 mar. 1986 (fl, fr), *Sinaca 486* (MEXU, US); Laguna Escondida, 18°35′N, 95°01′W, 200 m, 21 abr. 1985 (fl, fr), *Sinaca & Aparicio 73* (MEXU); Laguna Escondida, 20 abr. 1972 (fr), *Villegas 7* (MEXU, US); Municipio Soteapan, along dirt road 13 km E of Tebanca (13 km E of E side of Lago de Catemaco), 800–950 m, 5 July 1980 (fr), *Nee & Hansen 18768* (MEXU). CULTIVATED: U.S.A. **New York:** Ithaca, grown in the Cornell University Conservatory, as G-911, 23 June 1966 (fl), *Stone 136* (US).

At present it is difficult to relate *Solenophora tuxtlensis* to other species of the genus. It is distinctive by its long tubular calyx, its tubular corolla with dark purple spots on the lobes, and by having only one bilobed disc gland. A key to distinguish *S. tuxtlensis* from the other species found in Oaxaca and Veracruz is presented:

1a. Calyx nearly truncate, lobes 1–2 mm long.
  2a. Calyx tubular, base reddish; corolla lobes undulate . . . . . *S. maculata* D. Gibson
  2b. Calyx campanulate, base greenish; corolla lobes fimbriate . . . . . *S. insignis* (M. Martens & Galeotti) Hanstein
1b. Calyx lobulate, lobes 2–8 mm long.
  3a. Leaf margins serrate . . . . *S. obscura* Hanstein
  3b. Leaf margins biserrate . . *S. tuxtlensis* Ramírez-Roa & Ibarra-Manríquez

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Twelve New Species of *Merostachys* (Poaceae: Bambusoideae: Bambuseae) from Brazil

Tatiana Sendulsky
Herbário, Instituto de Botânica, Caixa Postal 4005, 01061-970, São Paulo, Brazil

ABSTRACT. Ten new species of *Merostachys*, *M. annulifera*, *M. argentea*, *M. bifurcata*, *M. calderoniana*, *M. lanata*, *M. leptophylla*, *M. magnispicula*, *M. medullosa*, *M. procerrima*, and *M. ramosissima*, from the state of Bahia, Brazil, and two, *M. fimbriata* and *M. rondoniensis*, from the state of Rondônia, Brazil, are described and illustrated. Some new and unusual characteristics for the genus (the branching of the main culm) in *M. ramosissima*, *M. fimbriata*, and *M. annulifera* are discussed.

In preparing a revision of the genus *Merostachys* Sprengel (Sendulsky, 1992, 1995), examination of herbarium material revealed ten undescribed species collected in the state of Bahia and two from Rondônia, Brazil, where the Bambusoideae appear to be one of the most successful and diverse groups of grasses, its members having adapted to these rich tropical rainforests.

Five of the species, *M. argentea*, *M. bifurcata*, *M. calderoniana*, *M. fimbriata*, and *M. procerrima*, are known only from vegetative material.

In daring to describe a new species based solely on sterile material I wish to make future bamboo collectors aware of the existence of these species and encourage them to search more objectively for additional, fertile collections, which may complete the present study.

The typical branching pattern for *Merostachys* and also for some species of *Arthrostylidium* and *Rhipidocladum* (the branch complement of apsidate insertion, McClure, 1973) consists of several to many, fasciculate, laterally oriented, slender, subequal, verticillate, leafy branches borne from a single bud at each node, alternately or distichously located and forming dense whorls, along a main culm.

BRANCHING MORPHOLOGY

Some of the new species (e.g., *M. ramosissima* and *M. fimbriata*) present unexpected, previously undescribed features for the genus *Merostachys*—the branching of the main culm with side branches of the first order that arise from some nodes and reach at times 7 m in length. These long branches also rebranch and produce leafy complements of apsidate insertion at each node. This unusual branching was first indicated in field notes by the late T. R. Soderstrom, collector of *M. ramosissima*. The rebranching was also mentioned only on the labels of *M. fimbriata* (holotype) by its collector Cleofe Calderón and of *M. annulifera* (*Calderón, Santos & Oliveira 2405*).

The collections of these three species always have long, leafy, first order branches with large leaves, referred to as "major culm leaves" or the "major culm leaf complement" (see discussions of *M. ramosissima* and *M. fimbriata*). The branch leaves of the second order branches or "side branch leaf complements" are smaller than those produced by the first order branches. Some other species—*M. medullosa*, *M. procerrima*, *M. magnispicula*, and *Merostachys* sp. (*Thomas, Carvalho, Jardim & Sant'Ana 9889*, MO, NY, SP)—apparently present a similar branching pattern as indicated by the presence of two sizes of leaves. In available specimens of the two latter species, the plants are in flower, and the flowering branches are of two orders, that is, the long leafy branches of the first order (Fig. 7) and smaller branch complements of the second order from "side branches" (Fig. 10e). The leaves on the long leafy branches of the first order in nearly all of the above-mentioned species share carinate sheaths with wide and hard keels.

Without understanding this peculiar branching pattern, it would have been impossible to accurately describe the species and compose the key. Because of the great differences in size of the branches and branch leaves, it will be difficult to correctly identify specimens unless there is an indication as to what part of the plant they came from. More fieldwork and precisely directed collecting are needed to fully understand these different morphological patterns.

Smaller leafy complements with smaller leaves may be of two different origins and sizes: (1) normal branch complements, developed directly from a main culm (monoclade branch complements of apsidate insertion) and usually densely and verticil-

lately arranged at every node of a main culm; and (2) small branch complements (mostly of a few branches) developed on each node of the thinner "side branches" (the long branches of the first order, which were produced by the "major culm node"). Both types of smaller branch complements are used in the key, except in the lead 8′, where blades of the large branch complement and the smaller branch complements are called normal branch complements.

KEY TO THE NEW SPECIES OF *MEROSTACHYS* FROM THE STATES OF BAHIA AND RONDÔNIA, BRAZIL

1. Branch leaf blades delicate, linear-lanceolate, 0.4–0.8 cm wide 2
1′. Branch leaf blades not so delicate, lanceolate, long-lanceolate, or broadly lanceolate 4
2(1). Oral setae of the branch leaves whitish, slightly undulate, not dense, spreading in all directions like spiders' legs . . . . . *M. leptophylla*
2′. Oral setae of the branch leaves erect, uprightly adhering, not very evident, sometimes absent 3
3(2). Oral setae of the branch leaves white-brownish, sometimes absent; culms 0.75–1.25 cm diam., scabrous; oral setae of the culm leaves white at the base, brownish at the points, 6–8 mm long; inner ligule of the culm leaf ca. 6 mm long, bifurcate . . . . . *M. bifurcata*
3′. Oral setae of branch leaves white-yellowish, brilliant; culms 2.3–2.6 cm diam., smooth; oral setae of the young culm leaves up to 3 cm long, silvery-white, brilliant, undulate, apically crispate; inner ligule of the culm leaf ca. 1 mm long, truncate . . . . . *M. argentea*
4(1). Branch leaf blades lanceolate, 7–8 cm long, 0.8–1.5 cm wide or long-lanceolate, 10.5–13 cm long, 0.7–1.1 cm wide 5
4′. Branch leaf blades oblong-lanceolate or long-lanceolate, (1–)1.6–3 cm wide 6
5(4). Blades lanceolate, 7–8 cm long, 0.8–1.5 cm wide; oral setae curly, dense, whitish, cottonlike; culm leaf sheaths glabrous . . . . . *M. calderoniana*
5′. Blades long-lanceolate, 10.5–13 cm long, 0.7–1.1 cm wide; oral setae straight, scarce, golden reddish; culm leaf sheaths lanate . . . . . *M. lanata*
6(4). Blades 7–20 cm long, (1–)1.6–3 cm wide 7
6′. Blades 4–16 cm long, 1–3.5 cm wide 8
7(6). Blades oblong-lanceolate, 7–20 cm long, 2.2–3 cm wide, asymmetrical (groups of larger leaves may be present); culm internodes hollow; oral setae white, dense, silky, neatly arranged . . . . . *M. procerrima*
7′. Blades oblong-lanceolate, 7–11.5 cm long, 1.6–2 cm wide; culm internodes filled with soft pith; oral setae copper-colored, dense, spreading in all directions . . . . . *M. medullosa*
8(6). Blades of normal branch complement broadly lanceolate, 7–12 cm long, 2.2–3.5 cm wide or 7.5 cm long, 2.6 cm wide 9
8′. Blades of large flowering branch complement 15–30 cm long, 2.8–4.5 cm wide or blades of normal flowering branch complement 4–13.5 cm long, 1–2.4 cm wide 11
9(8). Nodes thick, black, tirelike, not fringed . . . . . *M. annulifera*
9′. Nodes salient, fringed, not thick or black 10
10(9). Oral setae of culm leaves golden, 8–12 mm long; Rondônia . . . . . *M. fimbriata*
10′. Oral setae of culm and branch leaves dark at the base and whitish toward the tips, 5–7 mm long; culms branching, branches of the first order ca. 7 m long; Bahia . . . . . *M. ramosissima*
11(8). Blades of a normal branch complement 4–13.5 cm long, 1–2.4 cm wide; lower glume ca. 7 mm long, upper glume ca. 9 mm long; Rondônia . . . . . *M. rondoniensis*
11′. Blades of a large flowering branch 15–30 cm long, 2.8–4.5 cm wide; lower glume ca. 9 mm long, upper glume 11–12 mm long; Bahia . . . . . *M. magnispicula*

SPECIES FROM BAHIA

Merostachys annulifera Sendulsky, sp. nov. TYPE: Brazil. Bahia: Município Uruçuca, Estrada Serra Grande–Ilheus, km 2 (Mata de restinga), 20 Oct. 1983 (fl), *Santos, Soderstrom et al. 3906* (holotype, SP; isotype, MO). Figure 1.

Ab omnibus speciebus notis foliorum ramorum laminae late-lanceolatae, 7–12 cm latae, nodis crassis, nigris, inflatis differt.

According to collectors' notes (*Calderón & Santos 2236* and *Santos & Soderstrom et al. 3906*) this bamboo forms dense clumps of ca. 30(50–75) culms, these fistulose, 1–2.5 cm diam., strong, erect, pendulose above, reaching 10–15 m into the trees. Internodes ca. 57–95 cm long (many filled with water), scabrous, densely covered by small, sharp prickles, the walls 1.5–2 mm thick. Nodes thick, black, tirelike, hard. Culm leaves deciduous, sheaths thick, ca. 30 cm long, 8–10 cm wide, glabrous, somewhat scabrous abaxially, adaxially golden, shiny; oral setae ca. 5 mm long, dense, reddish; blades reflexed, broadly lanceolate, 14–15 cm long, 2–2.5 cm wide; inner ligule short, inconspicuous; outer ligule a short black rim. Branch complement with 20 branches, these 30–35 cm long, 1–3.5 mm thick, glabrous, smooth, 1–2-noded before the leaves, the nodes salient, black, shiny. Branch leaves 3–8 per complement, sheaths tight, glabrous, deeply sulcate, the overlapping margin finely cili-

ate; oral setae 10 mm long, straight or crispate; inner ligule short, finely ciliolate, the hairs whitish; outer ligule a ciliolate, inconspicuous rim; pseudopetiole flat, black, finely puberulent, waxy, 3 mm long; blades 7–12 cm long, 2.2–3.5 cm wide, broadly lanceolate, L:W = 3–3.1. A sterile large branch, ca. 33 cm long with 8 large leaves, blades ca. 20 cm long, 4.5–5.5 cm wide, glabrous, hard (probably from "major culm leaf complement"; see discussion under *M. ramosissima*), without indications from which part of the plant it was collected, sheaths somewhat hardened on the keel, the pseudopetioles black, finely puberulent. Inflorescence terminal on smaller leafy branches, spikelike, 5–7 cm long, with 12–22 spikelets; rachis and pedicels pilose. Spikelets 14 mm long, 2 mm wide, solitary, 1-flowered, attenuate, fusiform, pectinate, secund; Glumes 2, unequal; lower glume 1-nerved, 4 mm long, ca. 1.2 mm wide at the base, dark, finely puberulent; upper glume 10 mm long, 4 mm wide, aristulate, 9-nerved, the nerves dark, carinate, abaxially finely puberulent, the hairs whitish, adaxially shiny, brown, densely dark-spotted, some nerves anastamosing. Lemma 11 mm long, 5 mm wide, lanceolate, coriaceous, 15-nerved, finely puberulent, slightly strigose near the apex, adaxially shiny, dark-spotted. Palea 10 mm long, ca. 1.2 mm wide (folded), coriaceous, 12-nerved, glabrous at the base, finely puberulent apically, sulcate, finely ciliate along the keels, adaxially shiny; rachilla extension as long as the palea or a little longer, light colored, finely puberulent, with a minute rudiment. Lodicules 3, ca. 2 mm long, membranaceous. Ovary elongate, style single, the stigmas 2, plumose. Stamens 3; anthers ca. 5 mm long, black. Caryopsis not seen.

Phenology. This species was collected in flower in 1979, 1980, and 1983.

Distribution. Brazil, state of Bahia.

Paratypes. BRAZIL. **Bahia:** Município de Ibirataia: 23 km N of Ibirataia, on side road connecting with BR-101, Fazenda Macedonia, 250 m, 6 abr. 1976 (st), *Calderón, Santos & Oliveira 2364* (CEPEC, US); Município de Ilheu: road Olivença–Vila Brazil, ca. 30 km SW of Olivença, near rio Maroim, 22 Feb. 22 1979 (fl), *Calderón & Santos 2477* (MO, US); 21 km SW of Olivença on road to Vila Brasil (ex Ruinha), Faz. Ipiranga, 70 m, 23 May 1976 (st), *Calderón, Santos & Oliveira 2447* (US); Município Itajuipe: 4 km N of União Queimada on road to Pimenteira, Brazo do Norte of the Serra Geral, Fazenda Cordilhera, on summit of mountain, 705 m, 3 May 1976 (st), *Soderstrom, Russell & Hage 2185* (CEPEC, US); Município Ituberá: ca. 2 km from Ituberá on road to Gandú, Fazenda Inferno Verde, 230 m, 23 Apr. 1976 (st), *Soderstrom, Russell & Hage 2158* (CEPEC, SP, US); km 43 of road Gandú–Ituberá, ca. 13°46′S, 39°17′W, 300 m, 23 Apr. 1972 (st), *Calderón & Pinheiro 2236* (CEPEC, MO, US); Município Una: Reserva Biológica do Mico-Leão (IBAMA), 46 km N on BA-001, between Ilhéus and Una, 15°09′S, 39°05′W, 14 Nov. 1992 (st), *Thomas, Carvalho, Amorim, Jardin & Lisboa 9434* (CEPEC); Estação Experimental Lemos Maia, floresta ao lado W da estação, 11 Nov. 1980 (fl), *Rylands & Hage 49/1980* (CEPEC, MG); 19 km from Una on road to Santa Luzia do Salobro, 145 m, 27 May 1976 (st), *Soderstrom, Russell & Hage 2232* (CPEC, SP, US); Road Una–Olivença, 7 km N of Una (mata litoránea), ca. 15°15′S, 39°06′W, 50 m, 12 May 1972 (st), *Calderón & Pinheiro 2265* (CEPEC, MO, US); road Una–São José do Macuco, 18 km NW of Una, 110 m, 29 Apr. 1976 (st), *Calderón, Santos & Oliveira 2405* (CEPEC, SP, US); Road Una–Olivença, CEPLAC's Forestal Reserve Lemos Maia, ca. 7 km from Una, 27 Feb. 1979 (fl), *Calderón & Santos 2488* (MO, US); km 16.8 carretera vieja Una–Olivença (mata de restinga), 60 m, 18 Mar. 1992 (st), *Londoño, Santos & S. Sant'Ana 730* (CEPEC, SP, US); Estación experimental Lemos Maia de CEPLAC, a orilla de la carretera cerca a las instalaciones, 50 m, 25 Mar. 1992 (st), *Londoño, Carvalho & S. Sant'Ana 741* (CEPEC, US); Município Uruçuca: Camino de Serra Grande a Ilheus, 8 km de Serra Grande, 50 m, 18 May 1985 (st), *Zuloaga, Martinelli & Caruso 2471* (MO).

The collectors' notes on the label of *Calderón & Pinheiro 2236* say ". . . several thick branches from each node, usually 6," and on the label of *Calderón, Santos & Oliveira 2405* ". . . many thick branches at the nodes, over a meter long with a large leaf complement." All these notes indicate the unusual branching in this species. Is it possible that all these collected long branches with large leaves come from those "major culm leafy branches"? This question remains unanswered.

The unusual tirelike, thick, black nodes of this species appear to be autapomorphic characteristics of *M. annulifera.*

Merostachys argentea Sendulsky, sp. nov. TYPE: Brazil. Bahia: Município Porto Seguro, forest slopes of "morro" on Fazenda Carvalho, ca. 26 km W of town of Monte Pascoal, from 380 to 460 m, 15 May 1976 (st), *Soderstrom, Russell & Hage 2213* (holotype, CEPEC; isotypes, SP, US). Figure 2.

M. leptophyllae et *M. bifurcatae* similis sed foliis culmorum setis argenteis praeditis differt.

According to the collectors' notes: common bamboos, forming large clumps, with 25–30 culms, these 15–16 m tall, 2.3–2.6 cm diam., hollow. Internodes usually smooth, sometimes somewhat rough; walls ca. 1 mm thick. Nodes salient, with whitish line below. Culm leaves deciduous, sheaths 18–19 cm long, 9–11 cm wide, dark yellow, opaque, retrorsely finely scabrous toward the upper part, adaxially smooth, shiny, dark yellow; blades reflexed, deciduous, 7–9 cm long, 0.5–0.6 cm wide, attenuate to a fine point; oral setae of young culm

Figure 1. *Merostachys annulifera* Sendulsky. —a. Lower glume. —b. Upper glume. —c. Part of the inflorescence. —d. Lemma. —e. Palea. —f. Spikelet, lemma side. —g. Spikelet, palea side. —h. Large branch with large leaves—"major culm leaf complement" or "major culm leaves." —i. Branch complement in development. —j. Culm leaf. —k. Flowering branches of the smaller branch complement. —l. Ligule, oral setae, and base of the leaf. Based on *Calderón & Pinheiro 2236* and *Santos, Soderstrom et al. 3906.*

Figure 2. *Merostachys argentea* Sendulsky. —a. Base of the branch complement with a leaf complement. —b. Culm leaf sheath. —c. Oral setae and base of the leaf. —d. Young culm leaves. Based on *Soderstrom, Russell & Hage 2213.*

leaves up to 3 cm long, silvery-white, brilliant, slightly undulate, apically crispate; oral setae of the old sheath yellowish, 1.5 cm long, fine, minutely antrorsely scabrous; inner ligule ca. 1 mm long, truncate, firm; outer ligule a rim. Branch complement with ca. 130 branches, these 30 cm long, 1 mm thick, 2–3-noded before the leaves. Branch leaves 7–13 per complement, the lower, smaller

leaf distant below; sheaths tight, the upper margin finely ciliate; oral setae ca. 1 cm long, white-yellowish, brilliant, straight or slightly undulate, mostly broken, minutely scabrous; inner ligule a thick, dark membrane, less than 0.5 mm long, whitish on the margin; pseudopetiole black, finely pilose, the hairs white; blades delicate, linear-lanceolate, 8–10 cm long, 0.7–0.8 cm wide. L:W = 11.4–12.5, dull green, glabrous, finely nerved, 2–3 nerves on one side with rows of very fine prickle hairs, the margins finely scabrous. Reproductive structures not seen.

Phenology. This species has not yet been collected in flower. The only available specimens of this species are the holotype and isotypes.

Distribution. Brazil, state of Bahia.

Merostachys argentea has very delicate branch leaves, nearly as delicate as those of *M. leptophylla* and *M. bifurcata.* Because of these features it was frequently associated with these two species. It differs from them by its very long, silvery-white oral setae of the culm leaves. All three species have minute, antrorse hairs on the oral setae of the culm and of the branch leaves.

Merostachys bifurcata Sendulsky, sp. nov. TYPE: Brazil. Bahia: Município Porto Seguro, Parque Nacional Monte Pascoal, 14 km E of BR 101 at a point 13 km N of Itamarajú, 110 m, 12 May 1976 (st), *T. R. Soderstrom, Russell & Hage 2202* (holotype, US; isotypes, CEPEC, SP). Figure 3.

Ab omnibus speciebus notis folio culmorum ligula membranacea, ca. 6 mm longa et ca. 5 mm lata, bifurcata differt.

Climbing bamboo, with thin, weak culms reaching 10 m in length, 0.75–1.25 cm diam., erect at first, then arching out and vinelike, drooping over the vegetation. Internodes scabrous, greenish gray, striated dark and light green, with sharp, white prickles; walls thin. Nodes salient. Culm leaves deciduous; sheaths 20–25 cm long, 5–6 cm wide, thin and papery, abaxially scabrous, gray-whitish, partially covered with a rather thick white layer of wax, adaxially smooth, shiny, dark golden brown, sometimes also with spots of wax; inner ligule a thick membrane, ca. 6 mm long, 5 mm wide, bifurcate; outer ligule a fine, dark rim; blades erect to reflexed, 6–7 cm long, 0.3–0.4 cm wide; oral setae white at the base, brownish at the points, straight, slightly undulate, 6–8 mm long. Branch complement with 23–38 branches, these 35 cm long. Branch leaves delicate, 12–14 per complement, the lowermost leaf smaller, distant below; sheaths retrorsely scabrous, the upper margin ciliolate; oral setae 3–6 mm long, white-brownish, erect, uprightly adhering, not very evident, sometimes absent; pseudopetiole dark; inner ligule 0.5 mm long, dark, finely ciliolate; outer ligule a rim; blades linear-lanceolate, 3–13 cm long, 0.4–0.8 cm wide, L:W = 7.5–16.2, long acuminate, gray-greenish. Reproductive structures not seen.

Phenology. This species has not yet been collected in flower.

Distribution. Brazil, state of Bahia.

Paratypes. BRAZIL. **Bahia:** Município Belmonte, Reserva Gregorio Bondar of CEPLAC's Estação Experimental, 10 Apr. 1976 (st), *Soderstrom, Russell & Hage 2138* (CEPEC, SP, US); Município de Ibirataia, 23 km N of Ibirataia, on side road connecting with BR 101, Fazenda Macedonia, 250 m, 5 abr. 1976 (st), *Calderón, Santos & Oliveira 2359* (CEPEC, MO, US); Município de Porto Seguro, Arraial de Ajuda, Estrada Arraial de Ajuda para Trancoso, 30–40 m, Oct. 1983 (st), *Martinelli & Soderstrom 9656* (US).

Thomas R. Soderstrom, collector of the type specimen of this species, stated in his notes "... this bamboo grows right within the forest, climbing over the vegetation—the most graceful and beautiful species of the genus that I have seen." It is distinguished from all other species with delicate leaves by the sharply bifurcate inner ligule of the culm leaf.

Merostachys calderoniana Sendulsky, sp. nov. TYPE: Brazil. Bahia: Município de Una, road Una–Olivença, 20 km N of Una, 70 m, growing in coastal forest on sandy soil, 27 Apr. 1976 (st), *Calderón, Santos & Oliveira 2400* (holotype, US; isotype, CEPEC). Figure 4.

M. leptophyllae similis sed foliorum ramorum laminis lanceolatis, 7–8 cm longis et 8–15 mm latis et setis crispis, densis, albis differt.

Culms, according to collectors' notes, up to 10 m high, 1–1.5 cm diam., fragile, smooth, covered with white wax; young culms thin, asperous. Culm leaves deciduous; sheaths 12–16 cm long, ca. 3 cm wide, abaxially green-grayish, smooth, glabrous, dark-nerved, minutely retrorsely scabrous, covered with white wax, adaxially shiny, dark yellow, sometimes with a thick layer of wax and dark spots, young culm leaves densely transversely nerved toward the apex; oral setae 4–6 mm long, fine, dense, slightly yellowish, minutely antrorsely scabrous; inner ligule 0.5 mm long, indurate, dark, truncate; outer ligule a rim; blade reflexed, 9.5 cm long, 7 mm wide, stiff, asperous. Branch complement with 25–45 branches, these 20 cm

Figure 3. *Merostachys bifurcata* Sendulsky. —a. Young culm leaves. —b. Inner ligule of a branch leaf. —c. Culm leaf. —d. Bifurcate ligule of a culm leaf. —e. Surface of the culm. —f. Branch complement with a leaf complement. Based on *Martinelli & Soderstrom 9656.*

long, 2–3-noded before the leaves. Branch leaves 5–9(–13) per complement, lower smaller leaf distant below; sheaths tight, densely nerved, the upper margin ciliolate; oral setae whitish, dense, curly, sometimes cottonlike, very finely scabrous; inner ligule 0.2 mm long, firm; outer ligule a salient rim; pseudopetiole dark, glabrous; blades lanceolate, glabrous, dull green, 7–8 cm long, 0.8–1.5 cm wide, L:W = 8.7–9.6, 2–3 nerves on one side with rows of very fine prickle hairs, margins smooth or very sparsely scabrous. Reproductive structures not seen.

Phenology. This species has not yet been collected in flower.

Distribution. Brazil, state of Bahia.

Paratypes. BRAZIL. **Bahia:** Município Jaguaquara, ca. 9.5 km SE of Jaguaquara city, Faz. Mundo Novo, 700 m, 13 Apr. 1976 (st), *Calderón, Santos & Oliveira 2380* (CEPEC, SP, US); 8.5 km E of Jaguaquara city, Fazenda Mundo Novo, ca. 13°32′30″S, 39°55′W, 700 m, 7 May 1972 (st), *Calderón & Pinheiro 2252* (MO, US); Município de Jaquié, 28 km N of road Ipiau–Jequié, on road to Apuarema–Jaguaquara, Faz. São João, 750 m, 8 Apr. 1976 (st), *Calderón, Santos & Oliveira 2369* (CEPEC, MO, US); Município Una, km 35 via Olivença–Una, a 1.5 km por um ramal a la izquierda, 35 m, 17 Mar. 1992 (st), *Londoño, Santos & Sant'Ana 724* (CEPEC); Reserva Biológica do Mico-Leão (IBDF) km 8 da Rodovia Una–Ilheus BA-001, 28 Oct. 1987 (st), *Santos & Alves 120* (CEPEC); Reserva Biológica do Mico-Leão, entrance at km 46 of BA-001 Ilheus to Una, about 0.6 km from the main gate, 100 m, 15°09′S, 39°05′W, 6 Feb. 1994 (st), *Carvalho, Clark, Thomas, Kallunki & Sant'Ana 4370* (SP); Fazenda Santo Antonio ca. 10 km from Una on road to Canavieras, 26 May 1976 (st), *Soderstrom, Russell & Hage 2228* (CEPEC, US); Una, ca. 52 km S of Ilheus on M.C. road to Una, 55 m, restinga, 30 May 1991 (st), *Carvalho, Kobayashi & Santos 3344* (CEPEC); Santa Cruz Cabrália, mata costeira, 7 Nov. 1966 (st), *Belém & Pinheiro 2857* (CEPEC, US); Município Camacã, boundary of Municípios Camacã and Mascote, 24 km S of Camacã on BR 101, 8 Apr. 1976 (st), *Soderstrom, Russell & Hage 2130* (CEPEC, SP, US).

A number of similar but distinct species characterized by delicate branch leaves were collected together and sometimes given a provisional specific name. This material was sorted and processed in herbaria by this name or by general aspect, occasionally impeding the bamboo researcher's attempts to understand the species. Thus two new species, *M. leptophylla* and *M. bifurcata,* were primarily distinguished.

During my study of these two new species, I found two additional undescribed species included in this material because of similiarity of the delicate leaves. The first, represented by many sterile collections, is named *M. calderoniana* in honor of the prolific collector of this and numerous other bamboo species, colleague and friend Cleofe B. Calderón. This species differs by slightly wider branch leaves and whitish, dense, and curly oral setae. The other one is named *M. argentea* due to the long, striking, silvery-white oral setae of the young culm leaves.

Merostachys lanata Sendulsky, sp. nov. TYPE: Brazil. Bahia: Município de Porto Seguro on road to Eunápolis, forest on white sand, property of Lewis and Iva Lee Hartman, 40 m, 9 May 1976 (fl), *T. R. Soderstrom, Russell & Hage 2191* (holotype, US; isotypes, CEPEC, SP). Figure 5.

Ab omnibus speciebus notis vaginis foliorum culmorum lanatis differt.

According to the collectors' note: common, graceful bamboo, abundant at the edge of forest, forming very large clumps 1.8 m diam., of ca. 190 closely placed culms, these up to 10–15 m tall, 2.5–3 cm diam.; new culms purplish green, erect, then ascending at maturity and arching way over. Internodes above the nodes yellow and smooth or finely retrorsely scabrous, densely spotted with dark green stripes and spots and with white, short, scattered hairs; internode just below the node dark green, smooth, but longitudinally wrinkled; walls ca. 1 mm thick. Nodes salient, with a flat, ca. 1-mm-wide rim, densely bearded below, the hairs long, white. Culm leaves deciduous, falling at the time of branching; sheaths ca. 30 cm long, 9 cm wide, abaxially softly lanate, the hairs long, dense, brownish white, directed downward, more dense and longer toward the base, but apically glabrous, sparsely, retrorsely scabrous, adaxially shiny, smooth, golden brown, finely nerved; sheaths of the young culm leaves abaxially finely, retrorsely scabrous, then lanate toward the base, adaxially dark and densely tessellate toward the apex, with salient nerves; blades (according to collectors' field notes) borne upright, with age becoming horizontal to retrorse, ca. 10–16 cm long, 0.8–1 cm wide; oral setae ca. 1 cm long, reddish brown, slightly curly, sometimes whitish at the base; inner ligule ca. 1.5 mm long, dark, cartilaginous; outer ligule a short inconspicuous rim. Branch complement with (30–) 50–80 subequal branches, these 15–45 cm long; nodes a dark line. Branch leaves deciduous, 1–5 per complement; sheaths tight, glabrous, very finely ciliate on the upper margin; oral setae 6–8 mm long, straight, mostly scarce, fragile, sometimes dense, golden reddish; inner ligule dark, cartilaginous, irregular, ca. 0.5 mm long; outer ligule a light rim; pseudopetiole dark, glabrous; blades long-lanceolate, 10.5–13 cm long, 0.7–1.1 cm wide, L:W= 11.8–15, finely attenuate, glabrous on both surfaces, adaxially with 2–3 marginal nerves on one side with rows of very fine prickle hairs; margins finely scabrous. Inflorescence 4–6 cm long, terminal on leafy branches with laterally or distichously arranged spikelets, the rachis densely pilose, whitish; pedicels 0.3 mm long, pilose. Spikelets 7.5 mm long, 2 mm wide, attenuate, fusiform. Glumes 2, unequal; lower glume 2.5 mm long, ⅓ the length of the spikelet, 1-nerved; upper glume 5.5 mm long, 2 mm wide, 9-nerved, the nerves anastomosing, midnerve finely denticulate toward the apex. Lemma 7 mm long, 5 mm wide, 11-nerved, lanceolate, abaxially with sparse, long, whitish,

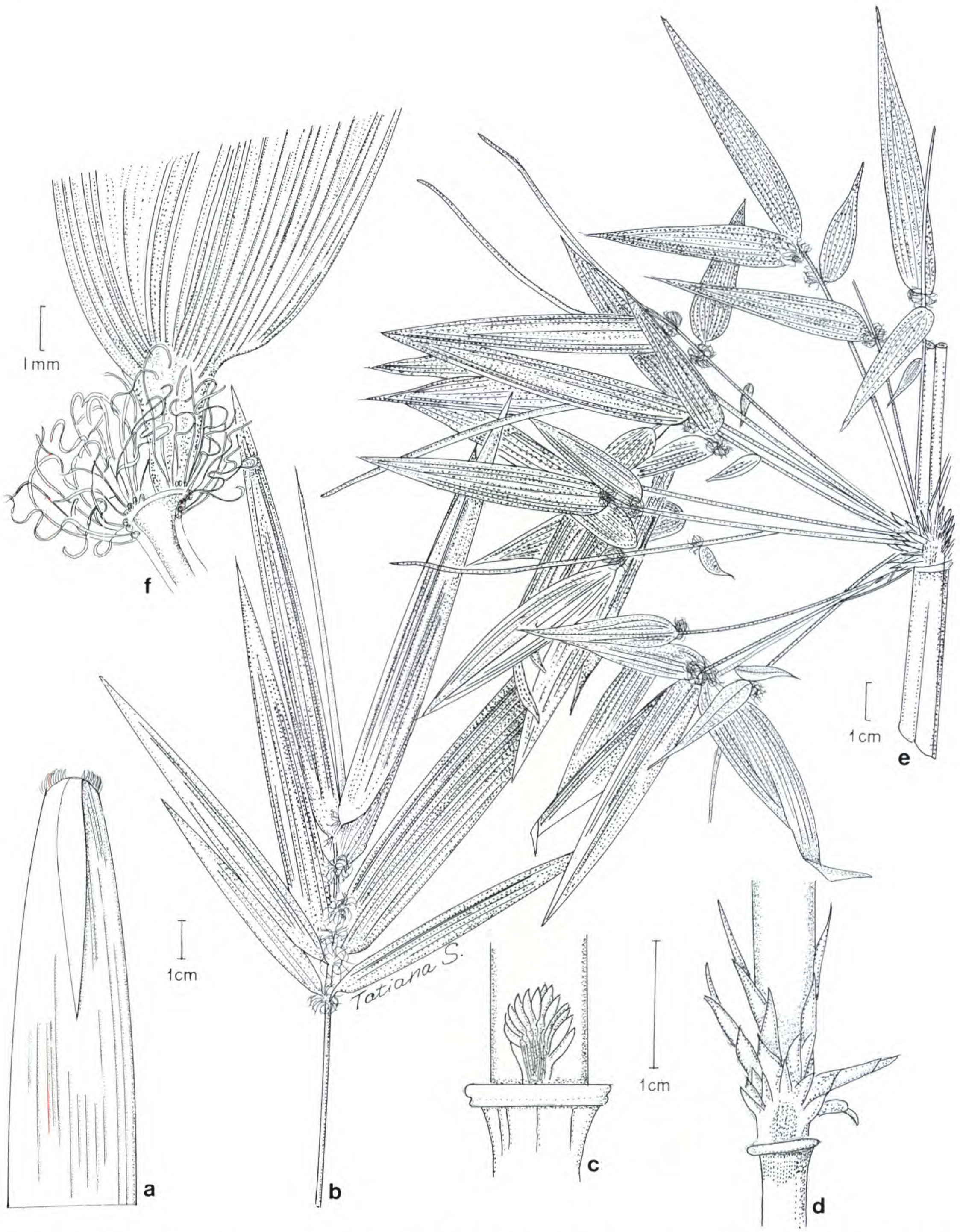

Figure 4. *Merostachys calderoniana* Sendulsky. —a. Culm leaf. —b. Leaf complement. —c, d. Branch complement in development. —e. Half of a normal branch complement. —f. Oral setae, inner ligule, and base of the leaf. Based on *Calderón, Santos & Oliveira 2400.*

rather thick hairs, adaxially pilose toward the apex. Palea 8.5 mm long, 3 mm wide, 8-nerved, glabrous, ovate-lanceolate, longer than the lemma, the keels of the palea finely denticulate; rachilla extension bristlelike, with a minute rudiment at the apex. Internode between the upper glume and the lemma 0.75 mm long, 0.75 mm diam., finely pilose, cup-shaped, with perfectly

Figure 5. *Merostachys lanata* Sendulsky. —a. Flowering branch complement. —b. Lower glume. —c. Spikelet. —d. Upper glume. —e. Lemma. —f. Palea. —g. Internode between the upper glume and the lemma. —h. Apical part of lemma. —i. Rachilla extention between the palea keels. —j. Culm leaf. —k. Culm leaf sheath. —l. Caryopsis. —m. Leaf complement. —n. Inner ligule of a branch leaf. —o. Oral setae and bases of the leaves. Based on *Soderstrom, Russell & Hage 2191.*

circular borders. Ovary elongate-fusiform, rostrate, with two long styles, stigmas not seen. Stamens 3; anthers 12 mm long, black. Caryopses 3.5–4 mm long, ca. 2.5 mm thick, ovoid, light brown, with one side asymmetrically swollen.

Phenology. This species was collected in flower only in 1976.

Distribution. Brazil, state of Bahia.

Paratypes. BRAZIL. **Bahia:** Município Belmonte: 27 km SW of Belmonte, forest on sand with bamboo predominant, 30 m, 11 Apr. 1976 (fl), *Soderstrom, Russell & Hage 2146* (SP, US); 24 km SW of Belmonte on road to Itapebí (restinga forest), low restinga and damp open areas on white sand, 0 m, approx. 39°03′W, 16°00′S, 24 Mar. 1974 (fl), *Harley 17388* (MO, US); Maraú, ca. 2 km of Maraú, mata hidrófila (road side), 0 m, 22 May 1991 (st), *Carvalho, Kobayashi & Pennington 3340* (CEPEC); Município de Porto Seguro: 8 km W of Porto Seguro, ca. 16°25′30″S, 39°8′W, 70 m, 4 Apr. 1972 (st), *Calderón & Pinheiro 2199* (CEPEC, MO, US); Parque Nacional Monte Pascoal, 14 km E of BR 101 at a point 13 km N of Itamarajú, forest on slopes of Monte Pascoal, 385 m, 13 May 1976 (st), *Soderstrom, Russell & Hage 2207* (CEPEC, SP, US); Município Santa Cruz Cabrália: 9 km SW of Santa Cruz Cabrália on road to Porto Seguro, restinga forest on white sand, 25 m, 9 May 1976 (st), *Soderstrom, Russell & Hage 2192* (CEPEC, SP, US).

Merostachys lanata is characterized by its lanate culm leaf sheaths and apparently is restricted to the sandy soil of the restinga forests. It shows some affinity with *Merostachys fischeriana* in the inflorescences with small spikelets, but differs by its sparsely pilose lemma.

Merostachys leptophylla Sendulsky, sp. nov. TYPE: Brazil. Bahia: Município Ibicaraí, between Ibicaraí and Floresta Azul, at 7 km from Ibicaraí, 270 m, 3 Apr. 1976 (fl), *T. R. Soderstrom, Russell & Hage 2106* (holotype, US; isotypes, CEPEC, SP). Figure 6.

M. calderonianae et *M. bifurcatae* similis sed setis tenuibis, effusis similitudine araneorum pernae differt.

Culms 9–12 m tall, 12–15 mm diam., smooth, green-grayish, the upper tips scabrous, the culm walls 1 mm thick. Nodes slightly salient, light-colored, glabrous. Culm leaves deciduous; sheaths 12–13 cm long, 3–4 cm wide, smooth, dark-spotted, adaxially smooth, shiny, with numerous transverse veins; blades reflexed, 8.5–13 cm long, 0.7–0.8 cm wide, deciduous, shortly strigose adaxially, abaxially glabrous or finely puberulent; inner ligule ca. 0.5 mm long, dark, cartilaginous; outer ligule an inconspicuous rim; oral setae 6–8 mm long, undulate, dense, curly at the tips, yellowish, brownish at the points, minutely scabrous. Branch complement with 50–65 very thin branches, these 30 cm long, 1 mm or less thick, 2–3-noded before the leaves. Branch leaves 5–11 per complement; sheaths tight, glabrous; oral setae fine, whitish, slightly undulate, borne on the very edge of the sheath on dark, amorphous, tuberculous bases, spreading in all directions like spiders' legs; pseudopetiole ca. 1.5 mm long, light green, nearly white, glabrous; blades delicate, long, linear-lanceolate, attenuate apically, slightly asymmetrical, 6.5–10 cm long, 0.4–0.8 cm wide, L:W = 12.2–16.5, green-grayish, more prominently nerved abaxially, adaxially with 2–3 marginal nerves on one side with rows of very fine prickle hairs, the margins scabrous. Inflorescence spikelike, pectinate or with distichously arranged spikelets, 2–3.5 cm long, with 4–9 spikelets, terminal on leafy branches, these bearing smaller leaves than those of the sterile branch complement; rachis densely pilose, the hairs whitish; pedicels pilose, 1.5 mm long. Spikelets ca. 8 mm long, 2.75 mm wide, fusiform, attenuate apically, glabrous. Glumes 2, unequal; lower glume 2 mm long, 1-nerved; upper glume ca. 6.5 mm long, 3.5–4 mm wide, ovate, attenuate, brownish, glabrous, opaque, rough, 7–9-nerved. Lemma ca. 7.5 mm long, hardened, fusiform, dark yellow, tightly embracing the palea. Internode between the upper glume and the lemma 0.25 mm long. Palea 6.5 mm long, hardened, fusiform, dark yellow, a little shorter than the lemma, very narrowly sulcate. Prolongation of the rachilla bristlelike, as long as the palea, light yellow, glabrous, with a minute rudiment, tightly enclosed between the keels of the palea. Internode between the lemma and the palea 0.75 mm long. Ovary ca. 1 mm long, rostrate. Caryopsis not seen.

Phenology. The only flowering specimen of this species is the type.

Distribution. Brazil, state of Bahia.

Paratypes. BRAZIL. **Bahia:** Município Porto Seguro, Parque Nacional de Monte Pascoal, Monte Pascoal, ca. 16°54′S–39°24′W, 210 m, 6 Apr. 1972 (st), *Calderón & Pinheiro 2202* (CEPEC, MO, SP, US); located 14 km E of BR 101, at a point 13 km N of Itamarajú, 110 m, 12 May 1976 (st), *Soderstrom, Russell & Hage 2204* (CEPEC, SP, US).

This is the most delicate species in the small group comprised by *Merostachys leptophylla, M. bifurcata,* and *M. argentea* with very narrow, delicate, green-grayish blades. According to the collectors' notes, the plant here described forms a dense clump of several hundred slender, weak, hollow culms, reaching into the trees. *Merostachys leptophylla* is distinguished by the most delicate leaves

Figure 6. *Merostachys leptophylla* Sendulsky. —a. Flowering branch complement. —b–f. Development of the branch complement. —g. Ovary. —h. Lodicules. —i, j. Palea. —k, l. Lemma. —m. Upper glume. —n. Lower glume. —o. Spikelet. —p. Leaf complements. —q. Oral setae of the branch leaves. —r, s. Culm leaf. —t. Inner ligule. Based on *Soderstrom, Russell & Hage 2106* and *Calderón & Pinheiro 2202.*

and by white, not dense, slightly curly, oral setae spreading in all directions like spiders' legs.

Merostachys magnispicula Sendulsky, sp. nov. TYPE: Brazil. Bahia: Ilheus, Salobrinho, 18 Dec. 1968 (fl), *Almeida & Santos 289* (holotype, CEPEC). Figure 7.

M. rondoniensi similis sed laminis ramorum floriferorum 15–30 cm longis et 28–45 mm latis, spiculis 13–15 mm longis et 4 mm latis differt.

Habit unknown; only fragments of the branch complement available. A large branch 41 cm long, terminating in inflorescence, with cut off base, the lower part covered by sheaths, these glabrous, hard,

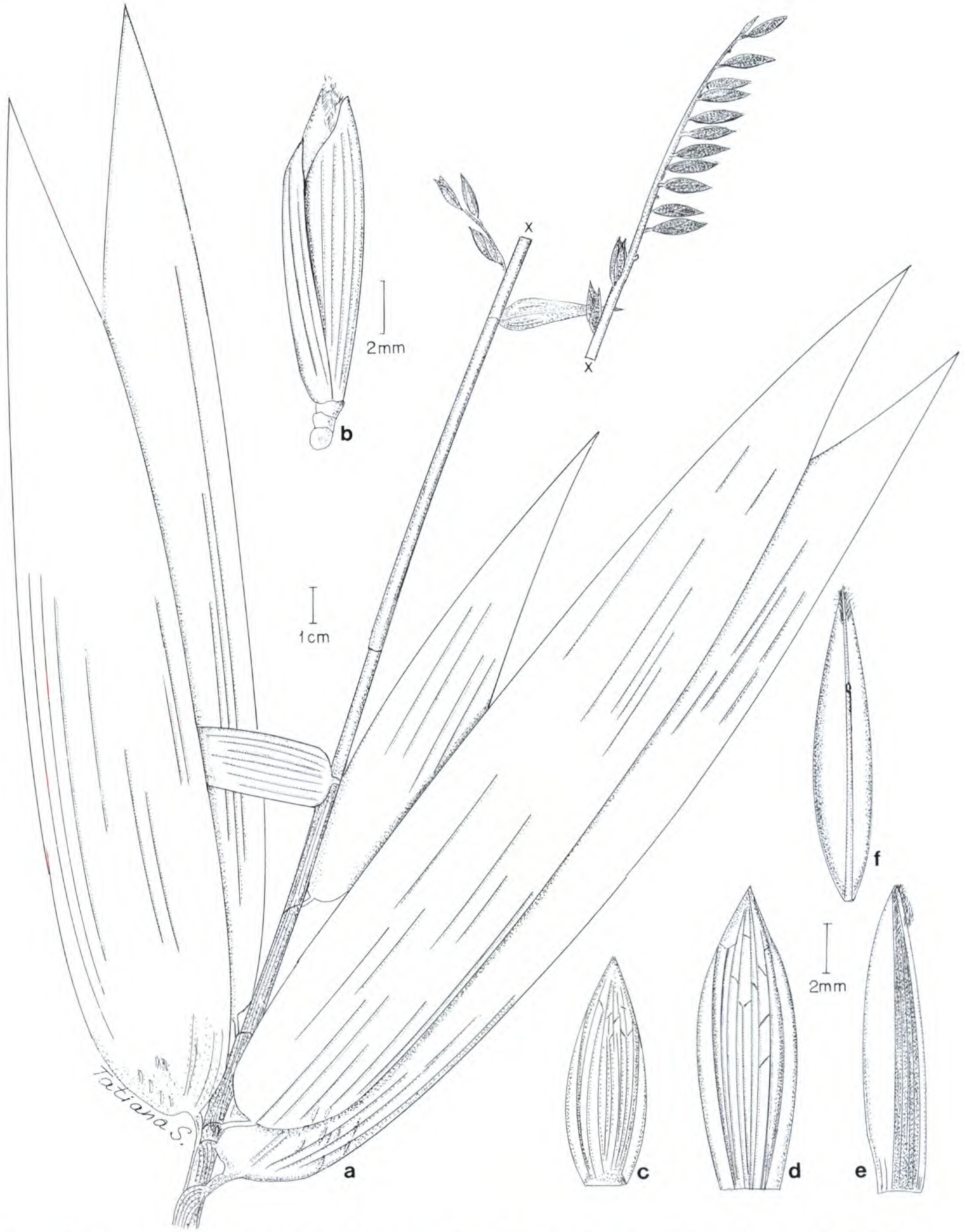

Figure 7. *Merostachys magnispicula* Sendulsky. —a. Large flowering branch with large leaves. —b. Spikelet. —c. Lower glume. —d. Upper glume. —e. Lemma. —f. Palea. Based on *Almeida & Santos 289*.

somewhat broadly carinate, strongly nerved, transversely finely rugose between the nerves; outer ligule a cartilaginous rim; inner ligule and the abaxial side of the leaves not seen; sometimes 3–4 very small and weak oral setae present at the top of the sheath; pseudopetiole ca. 1 cm long, 3 mm wide, light-colored, transversely rugose, glabrous; blades very large, up to 15–30 cm long, 2.8–4.5 cm wide, lanceolate, hard, glabrous, the uppermost leaves near the inflorescence smaller. Small branch com-

plement with 6 branches, these 20–22 cm long, without the leaves, only inflorescences. Inflorescence 8–12 cm long; rachis and pedicels finely puberulous. Spikelets 13–15 mm long, 4 mm wide, pectinate. Glumes 2, unequal; lower glume 9 mm long, 2 mm wide, acuminate, glabrous, with 9–11 irregularly distributed nerves, the 1–3 central nerves carinate, salient, forming folds at base abaxially, many nerves anastomosing, the margins finely ciliate toward the apex; upper glume 11–12 mm long, 5 mm wide, with 17 irregular nerves, nerves mostly obliquely anastomosing, the margins finely ciliate. Lemma 10 mm long, 5 mm wide, folded, fusiform, hard, cartilaginous, yellowish, glossy, 15–17-nerved, the nerves anastomosing, irregular, evident only adaxially, the margins finely lanate toward the apex, the hairs whitish. Palea 11 mm long, 2 mm wide, folded, cartilaginous, glossy, 12-nerved, evident only adaxially, the nerves obliquely anastomosing toward the apex, narrowly sulcate, the keels and the margins finely woolly toward the apex. Rachilla extension bristlelike, 6.5 mm long, whitish, with a minute rudiment. Caryopsis not seen.

Phenology. The only available specimen of this species is the holotype, collected in flower in 1968.

Distribution. Known only from the type locality, state of Bahia, Brazil.

Merostachys magnispicula shows a strong morphological affinity with the material of the following collection: *Thomas, Carvalho, Jardim & Sant'Ana 9889* (MO, NY, SP) from Bahia, Município Belmonte, Barrolandia, Estação Experimental "Grigorio Bondar" CEPLAC, 18 km E of BR 101 on road to Belmonte, 16°8′S, 39°15′W. Southern Bahian wet forest (tabuleiro forest), adjacent "mussununga" savana, 12 May 1993 (fl). This collection is not yet described; it differs by having the smaller spikelets 11–12 mm long, 3 mm wide, and by the presence of more developed oral setae. *Thomas et al. 9889* also has one long flowering branch with large leaves, similar to *M. magnispicula*, without any indication as to what part of the plant it was collected from, but it may possibly come from a "major culm leaf complement" (see discussion in *M. ramosissima*). The two collections may be conspecific, although these two bamboos apparently have different flowering cycles; further collections of more complete material are needed to determine their relationship. *Merostachys magnispicula* also shows affinity to *M. rondoniensis*.

A photograph of the flowering branch of *Merostachys magnispicula* (*Almeida & Santos 289* (CEPEC)), though unnamed, first appeared in Kobayashi (1994). The specimen draws attention because of its singular and magnificent appearance.

The description of *Merostachys magnispicula* is based on a single, poor herbarium specimen; thus the morphological details of the inner ligule and the adaxial surface of the leaves could not be examined—the material was completely glued to the sheet.

Merostachys medullosa Sendulsky, sp. nov. TYPE: Brazil. Bahia: Município Porto Seguro, forested slopes of "morro" on Fazenda Carvalho, ca. 26 km W of town of Monte Pascoal, at end of road that intersects with BR 101 in Monte Pascoal, 380–460 m, 15 May 1976 (fl), *T. R. Soderstrom, Russell & Hage 2212* (holotype, US; isotypes, CEPEC, SP). Figure 8.

Ab omnibus speciebus notis culmis maturis medullosis, foliorum culmorum setis cupreis, extensis differt.

Robust bamboo with culms 10–15 m long, 2 cm diam., growing on the upper slopes of mountains, becoming very thin at tips and arching over the vegetation. Clumps of ca. 50 culms, these gray-green, striate-mottled dark and light green, finely retrorsely scabrous, slightly pilose, the hairs appressed, white. Internodes with very thick walls and filled with soft pith, in small branches hollow. Nodes salient, light colored, densely bearded below, hairs white, long. Culm leaves deciduous; sheaths very long, ca. 50–75 cm long, 5 cm wide at the base, long-triangular, attenuate to a point apically; oral setae 1.5 cm long, scarce, sometimes very dense, copper-colored, straight or undulate; inner ligule (1.5)2–2.5 mm long, dark, membranous, shortly bifurcate, the angles not sharp, with lighter, minutely ciliate margins; outer ligule salient, concave in shape, dark rim, located below the tip of the sheath; blades deciduous, 13 cm long, 0.4 cm wide, the blade erect at first then reflexed. Branch complement with (8–)12–54 branches, these 26–34 cm long, 2–5 mm thick, glabrous, smooth. Branch leaves 10–17 per complement, the lowermost smaller; sheaths tight, densely strigose, auriculate, the upper margin ciliate, the auricles rounded, glabrous abaxially, adaxially with numerous oral setae 12–15 mm long, undulate, dark yellow or copper-colored, with long papillose bases, when the auricles reflexed, the oral setae are exposed in all directions; inner ligule a thick membrane, 0.3 mm long; outer ligule a rim; pseudopetiole dark, glabrous; blades 7–11.5 cm long, 1.6–2 cm wide, L:W = 4.3–5.7, asymmetrical, broadly and long lanceolate, attenuate apically, the margins finely scabrous, nerves not manifest adaxially.

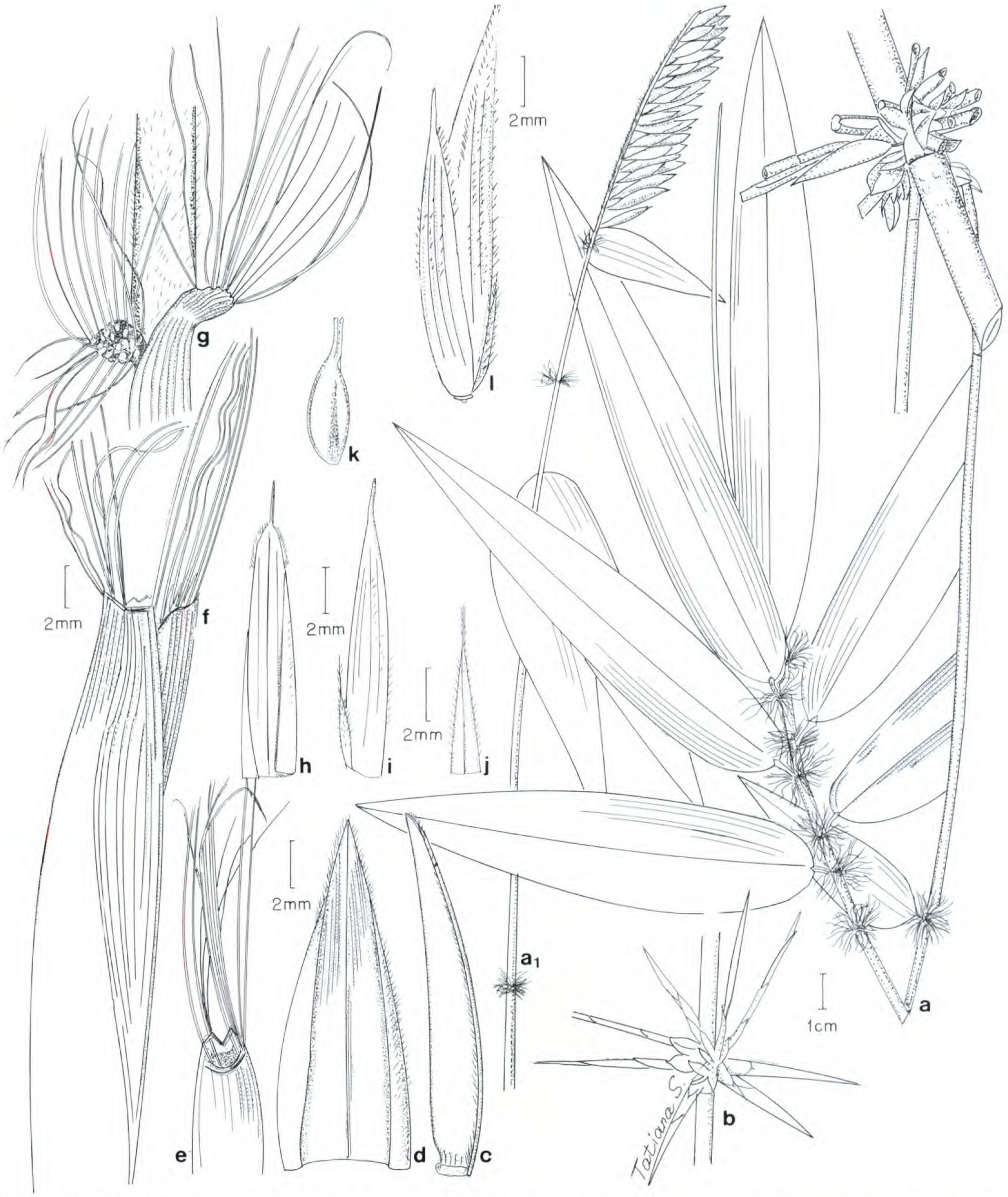

Figure 8. *Merostachys medullosa* Sendulsky. —a. Branch with leaf complement. —a_1. Inflorescence. —b. Branch complement in development. —c. Palea. —d. Lemma. —e. Bifurcate ligule (abaxial side) of a culm leaf. —f. Upper part of the culm leaf. —g. Reversed position of the auricle with oral setae of the branch leaf. —h. Upper glume. —i. Lower and upper glumes (lateral view). —j. Lower glume. —k. Ovary. —l. Spikelet. Based on *Soderstrom, Russell & Hage 2212.*

Large sterile branch 32 cm long with large leaves 10–22 cm long, 2.5–3 cm wide present. Inflorescence 5–10 cm long, ca. 2 cm wide, terminal on leafy branches, spikelike, pectinate; rachis and pedicels densely hispid. Spikelets 16 mm long, 0.4 cm wide, densely hispid on the upper part, on the lower finely scabrous. Glumes 2, unequal; lower glume 6 mm long, 1-nerved, densely ciliate at the margins and long hispid along the nerve; upper glume apiculate, ovate, slightly carinate, 13 mm long, 5 mm wide, hispid, densely ciliate at the margins. Internode between the upper glume and the

lemma 1 mm long, cup-shaped. Lemma 15 mm long, 8 mm wide, triangular, apiculate, ciliate at the margins, the hairs dark brown, surface densely strigose and very finely scabrous toward the base, adaxially shiny, brown, ca. 17-nerved, the nerves inconspicuous, anastomosing. Palea 16 mm long, ca. 22 mm wide, glabrous, finely ciliate at the keels, finely scabrous toward the top, with a few long hairs at the base; extension of the rachilla as long as the palea, with a minutely leaflike rudiment; ovary 6 mm long, ovoid, styles two, anthers 9 mm long, black. Caryopsis not seen.

Phenology. This species has been collected in flower only in 1976.

Distribution. Brazil, state of Bahia.

Paratypes. BRAZIL. **Bahia:** Município Jaguaquara, ca. 9.5 km SE of Jaguaquara, Fazenda Mundo Novo, 700 m, 13 Apr. 1976 (fl), *Calderón, Santos & Oliveira 2379* (CEPEC, MO, US); 6–8 km E of Jaguaquara city, Fazenda Mundo Novo, ca. 13°32′30″S–39°55′W, 70 m, 6 May 1972 (st), *Calderón & Pinheiro 2251* (CEPEC, MO, US); Município Prado, ca. 10 km S of Prado, low, littoral forest, 50 m, 12 Apr. 1976 (st), *Soderstrom, Russell & Hage 2149* (CEPEC, US); Município Ubaira, 2 km E of Ubaira on road to Mutuipe, forest slopes above rocky stream in Fazenda Pindaba de Dentro, 475 m, 27 Apr. 1976 (st), *Soderstrom, Russell & Hage 2166* (CEPEC, SP, US); Município Una, 15 km from Una on road to Santa Luzia do Salobro, 60 m, 27 May 1976 (fl), *Soderstrom, Russell & Hage 2231* (CEPEC, US); 3.5 km S of Una on road Una–Santa Luzia, 25 May 1976 (fl), *Calderón, Santos & Oliveira 2451* (CEPEC, MO, US).

Merostachys medullosa is distinguished from all the other species in the genus by the culm internodes filled with soft pith.

Merostachys procerrima Sendulsky, sp. nov. TYPE: Brazil. Bahia: Município Porto Seguro, Reserva Biológica do Pau Brazil (CEPLAC), primary hygrophilic forest with tall trees, 35 m, 7 May 1976 (st), *Soderstrom, Russell & Hage 2187* (holotype, US; isotypes, CEPEC, SP). Figure 9.

Ab omnibus speciebus notis laminis oblongo-lanceolatis vel late-lanceolatis, 7–34 cm longis, foliorum culmorum juvenum vaginae et laminis purpureis, setis albis, densis differt.

Slender culms of 4–5 in a clump, 3–4 m tall, 1.5 cm diam., weak, supported by shrubs and small trees, erect and glabrous below, thin and scabrous above, gray-yellowish; walls ca. 1 mm thick. Nodes salient. Culm leaves deciduous; sheaths 18 cm long, 6 cm wide, slightly asperous, adaxially shiny. According to the collectors' notes, new culm sheaths purplish green or deep purple, becoming stramineous and pushed off by developing branches; blades purplish green, deciduous, reflexed, 6–7 cm long, 7 mm wide. Branch complement with 3–4 short branches, these 6–20 cm long, borne on very thin, retrorsely scabrous culms or branches, 2–4 mm thick. Branch leaves 3–8 per complement: sheaths tight, hardened, strongly nerved, sometimes dorsally carinate, auriculate; auricles straight or slightly rounded, 3 mm long, giving rise to dense line of silky-white, neat oral setae, these 1 cm long, undulate in the upper part; inner ligule dark, cartilaginous, 0.5 mm long; outer ligule a rim; the pseudopetiole 7 mm long, dark, purple to black (according to the collectors' notes); blades oblong-lanceolate, 7–20 cm long, 2.2–3 cm wide, L:W = 3.1–6.6, light green, many-nerved, but smooth on both surfaces, apically abruptly attenuate, the base asymmetrical, nerves more prominent abaxially. Bigger branches 17 cm long, 3.5 mm thick, borne on thicker culms or branches, with 6–8 larger leaf-blades 20.5–24.5 cm long, 3–3.6 cm wide, with the same characteristics as above-mentioned blades of the smaller branch complements. The third kind of branches of unknown branch complement presents branches of 43 cm long, 5 mm thick, with very strongly nerved and longitudinally wrinkled blades, these 18.5–34 cm long, 2.2–4.5 cm wide, broadly and long lanceolate, the surface with the appearance of a very old leaf, its sheaths carinate with hard, wide, dorsal keels; oral setae dark, mostly broken or fallen. Reproductive structures not seen.

Phenology. The species has not yet been collected in flower.

Distribution. Brazil. States of Bahia and Espirito Santo.

The name for this species was given by one of the collectors, the late T. R. Soderstrom, due to its elegant appearance.

Paratypes. BRAZIL. **Bahia:** Município Camamú on road to Ubaitaba, forest on hill above stream, 215 m, 22 Apr. 1976 (st), *Soderstrom, Russell & Hage 2157* (CEPEC, SP, US); Município Porto Seguro, Parque Nacional Monte Pascoal, 14 km E of BR 101 at a point 13 km N of Itamarajú, 110 m, 11 May 1976 (st), *Soderstrom, Russell & Hage 2198* (SP); Município Santa Cruz Cabrália, Reserva Biológica Pau Brazil (CEPLAC), 16 km W of Porto Seguro, ca. 16°23′S–39°11′W, 100 m, 31 Mar. 1972 (st), *Calderón & Pinheiro 2194* (CEPEC, MO, US). **Espirito Santo:** Município Conceição de Barra, Distrito de Dunas de Itauna, Fazenda Boa Vista, 6–8 km from Dunas de Itauna, 50 m, restinga arbórea, 29 Oct. 1983 (st), *Martinelli & Soderstrom 9710* (US).

Merostachys ramosissima Sendulsky, sp. nov. TYPE: Brazil. Bahia: Município Ubaira, 3 km E of Ubaira and 11 km W of Matuipe, 425 m, 26 Apr. 1976 (fl), *Soderstrom, Russell & Hage 2164* (holotype, US; isotypes, CEPEC, SP). Figure 10.

Figure 9. *Merostachys procerrima* Sendulsky. —a. Large branch with large leaves—"major culm leaf complement." —b. Inner ligule. —c. Branching of the "side branch." —d. Leaf complement of the "side branch." —e. Upper part of the branch leaf sheath. Based on *Soderstrom, Russell & Hage 2187*

Ab omnibus speciebus notis ramificationibus ramificantibus, laminis longo-lanceolatis, 15–16 cm longis, 1.8–2.1 cm latis, setis flavescentibus, ad bases fuscis differt.

According to the collectors' notes, culms 12–15 m long, not erect, but arching out and reaching into the trees, smooth except the upper scabrous parts, 2–3.5 cm diam., yellow-greenish, glabrous, sometimes shiny above the nodes; main culm producing side branches of the first order, these reaching ca. 7 m in length and again rebranching. Internodes ca. 98 cm long;

walls 1.5 mm thick. Nodes salient, densely pilose below, the hairs white. Culm leaves not falling easily; sheaths 40 cm long, 10–11 cm wide, hard, brittle, rounded on the summit, slightly auriculate, abaxially glabrous, opaque, brownish, with fine nerves, adaxially golden brown, shiny; oral setae fine, dark, 5–6 mm long, whitish and crispate at the points; inner ligule a very short, dark membrane; outer ligule a fine, dark rim; blade deciduous, reflexed, 12 cm long, 18 mm wide, hard, on both surfaces finely hispid toward the upper part. The entire "leafy branch complement of the major culm" not seen, one branch from this complement 68 cm long, 3–5 mm thick, branch leaves 12 per complement; sheaths strongly carinate, with wide, thick keel; oral setae dark at the base, whitish and crispate at the tips, ca. 5 mm long, slightly diminishing in size downward along the upper margin of the sheath; inner ligule a hard, dark membrane; outer ligule a rim; blades long-lanceolate, (2.5–)12–31 cm long, 1–4 cm wide, finely scabrous, glabrous on both surfaces, the nerves more prominent abaxially. "Side branch leaf complement" with 4–5 second order branches, these 21–23 cm long, 2.5 mm thick, branch leaves 5–7 per complement: sheaths tight, pubescent, hairs white, sometimes rather dense; oral setae yellowish, with dark bases, apically crispate, 7 mm long, in a row, slightly diminishing in size downward along the upper margin; inner ligule very short, dark, hard membrane, 0.5 mm long; outer ligule a rim; blades 15–16 cm long, 1.8–2.1 cm wide, L:W = 7.6–8.3, asymmetrical, abaxially finely scabrous and with more prominent nerves, adaxially with 2–3 lateral nerves on one side with rows of very fine prickle hairs, more dense toward the summit (not toward the base, as in other species), margins sparsely denticulate. Inflorescence 8 cm long, 4.2 cm wide, rachis 2.5 mm thick, densely hispid; spikelets paired, distichous along the rachis; pedicels adnate, hispid. Spikelets 20–22 mm long, 2.5 mm wide, long-fusiform, on summit with 3 awnlike points. Glumes 2, unequal; lower glume 1.5 mm long, apiculate, 1-nerved, ciliate on the margins and along the nerve; upper glume 10 mm long, ca. 3.5 mm wide, apiculate. Lemma 13 mm long, 7 mm wide, lanceolate, 13-nerved, aristulate, the awn 3 mm long, finely scabrous, the nerves irregularly distributed, some nerves anastomosing. Palea 13 mm long, 5 mm wide, glabrous, narrowly sulcate, 8-nerved, long-bifid, forming 2 awnlike, dark, scabrous points, these together with aristulate lemma make 3-awned apex of the spikelet. Rachilla extension nearly as long as the palea, with a minute rudiment at the apex. Caryopsis 12 mm long, 4 mm wide, dark yellow, the surface shiny, but uneven, resembling leather (one side of the caryopsis completely destroyed by insects).

Phenology. The only available specimen of this species, the holotype, flowered in 1976.

Distribution. Known only from the type locality, state of Bahia, Brazil.

According to Soderstrom's field notes: ". . . Clumps of 3–4 spaced culms that are not erect but arch out and reach into the trees. At first, nodes break above and 3 major branches are produced, then 2 more—5. The branches borne very long and pendant; then nodes branching again. Culms 12–15 m in height. Many more branches than 5 can eventually be produced at mature nodes and only some of those elongating. It may be that in young canes, i.e., in young plants, the culms produce at first only leaf complements and no branches. In the species these hanging branches rebranch. The bamboo occurs only on the top of "serra." Side branches to 7 m long, perhaps more. This bamboo grows in shaded, somewhat open forest, on sandy soil with light layer of humus. 1 branch found coming from the ground (fallen culms?) in which 2 branches are in flower." See also Soderstrom's schematical diagram "d" reproduced in Figure 10 with the following explanations:

—a_1. On some nodes of some culms there are normal long leaf complements of the first order as found in other species of *Merostachys.* Those were pressed and marked as "major culm leaves" or "major culm leaf complement." Maybe such a condition occurs in culms of young plants and branching occurs in older plants.

—b_1. The branches from the main culm produce second order leaf complements at each node. These nodes with leaf complements, or branch complements, were pressed as "side branches."

—c_1. The first order side branches are up to 7 m long.

In the studied collection only one inflorescence was available and, according to the collectors' note, from a fallen culm. The inflorescence examined was in a poor, deplorable state; the tissues were rotten, the spikelet falling into pieces at the slightest touch. Better collections of this species are desirable to enrich our understanding of its branching system.

Species from Rondônia

Merostachys fimbriata Sendulsky, sp. nov. TYPE: Brazil. Rondônia: Macisa/Maciça/cassiterite mine, about 17 km N of São Lourenço mine on NW site of Rio Madeira, 17 July 1979 (st), *Calderón & Monteiro 2870* (holotype, MO). Figure 11.

Ab omnibus speciebus notis nodis crassis, fimbria densa, alba, longa sub nodo praedita differt.

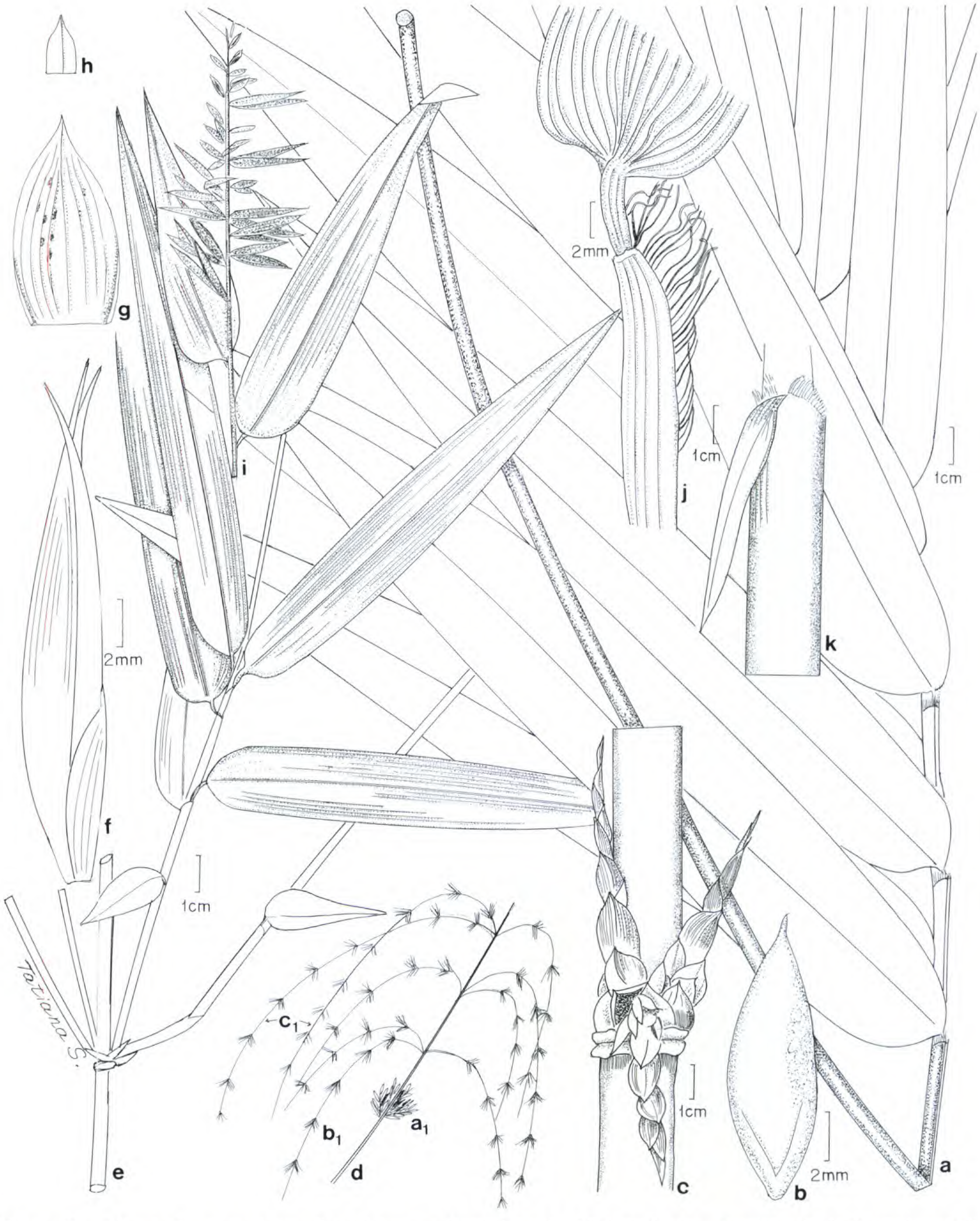

Figure 10. *Merostachys ramosissima* Sendulsky. —a. Large branch with large leaves—"major culm leaf complement." —b. Caryopsis. —c. Initial stage of branching in "major culm." —d. Soderstrom's schematical diagram (explanations in the text). —e. Leaf complement of "side branches." —f. Spikelet with aristulate lemma and long-bifid palea. —g. Upper glume. —h. Lower glume. —i. Inflorescence. —j. Sheath and oral setae of side branch leaf. —k. Culm leaf. Based on *Soderstrom, Russell & Hage 2164.*

Robust bamboo ca. 8 m tall, leaning on vegetation, with strong, slim culms. Internodes very long, about 1.20 m, with thick walls. Nodes salient, glabrous, with a fine ridge below, fringed with long, whitish, dense hairs, directed downward. Culm leaf sheaths of new and thin culms 10–12 cm long, 3–3.5 cm wide, abaxially finely scabrous toward the apex, partially tomentose-velutinous toward the

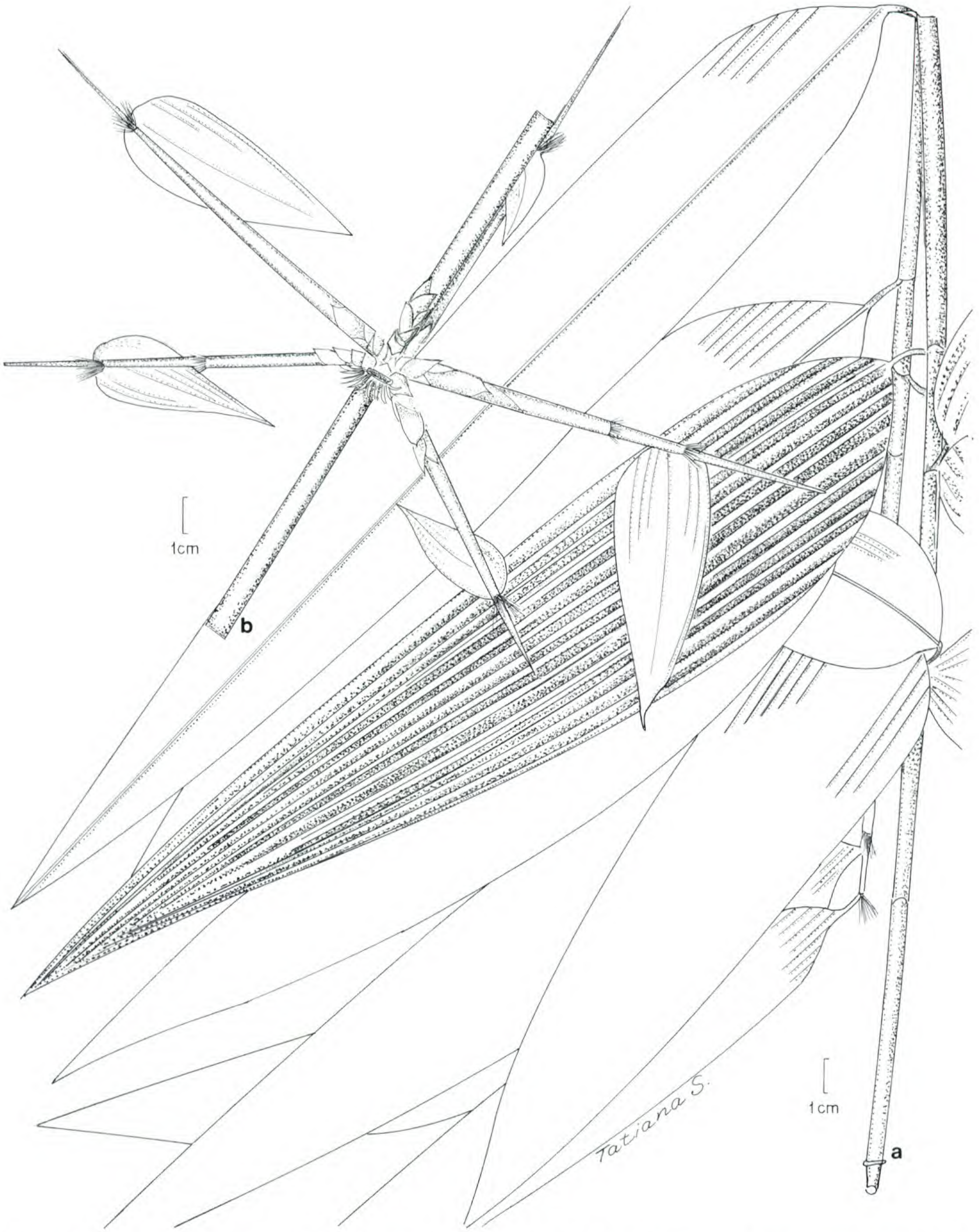

Figure 11. *Merostachys fimbriata* Sendulsky. —a. Large branch with large leaves. —b. Branch complement in development with fimbriate node. Based on *Calderón & Monteiro 2870.*

base, the hairs brownish, adaxially golden, shiny; inner and outer ligules inconspicuous, oral setae fine, 8 mm long, golden; blade not seen. Branch complement of 5–6 branches, these 10–12 cm long, with one broadly lanceolate leaf, 7.5 cm long, 2.6 cm wide (the leaf complement in early stage of development). Sterile large branch 57 cm long, ca. 5 mm thick, with 14 mature leaves: sheaths tight, broadly carinate, glabrous; oral setae golden, straight, crispate at the points, 10–12 mm long; pseudopetiole 10 mm long, 3 mm wide; blades 30 cm long, 4.5–5 cm wide, long-lanceolate, attenuate

at the apex, asymmetrical, densely nerved and deeply sulcate longitudinally, the midnerve evident abaxially only. Reproductive structures not seen.

Phenology. The only available specimen of this species is the type, collected sterile in 1979.

Distribution. Known only from the type locality, state of Rondônia, Brazil.

According to the collectors' notes: "Branch complement of a few branches which in turn rebranch." The rebranching of the first order long branches is very rare in *Merostachys* and not the expected manner of growth in the genus; it is certainly known only for *M. ramosissima* from Bahia, also described here and not clearly understood. The herbarium material of *M. fimbriata* presents two kinds of branches, probably from two different branch complements—a short branch, with a few small leaves (it may correspond to Soderstrom's "leaf complement" or "branch complement of the side branches," see *M. ramosissima*), and one mature and long branch, with large and long leaves (corresponding to the branch of Soderstrom's branch from the "major culm leaf complements").

The observations of the branching were given only in the collection of *M. ramosissima* (*Soderstrom, Russell & Hage 2164*) and short, but clear indications in *M. fimbriata* (*Calderón & Monteiro 2870*) and in *M. annulifera* (*Calderón, Santos & Oliveira 2405*). There are no observations on the ramification in *M. procerrima* or in *M. medullosa.* Is it possible that they might all be branching species and that during collecting in the dense forest, where all branches are interlaced, this branching tendency was not observed? Only future collections may provide a clue to answer this question.

It is expected that future precisely directed collections will better show this rare and unusual branching and demonstrate the successive branching, its origins and development.

The presence of a fringe of long dense hairs, hanging from the tubiform crest below the salient node, is an autapomorphic characteristic in this species. The available material for study is very scarce and unfortunately glued to the sheet, not permitting accurate examination.

Merostachys rondoniensis Sendulsky, sp. nov. TYPE: Brazil. Rondônia: Manaus–Porto Velho Highway, 7 km N of Porto Velho, growing in secondary forest near the road, 7 July 1979 (fl), *Calderón, Monteiro & Gedes 2780* (holotype, MO). Figure 12.

M. magnispiculae similis sed laminis ramorum florifer-orum 4–13.5 cm longis et 1–2.4 cm latis, spiculis 15–17 mm longis et 4 mm latis differt.

Habit unknown. Culms finely retrorsely scabrous, 1.5 cm diam., with very thin walls. Nodes dark, salient, finely pilose on lower part and below, the hairs white, sometimes forming a white line. Culm leaves deciduous; sheaths 12 cm long, 4–5 cm wide, light brown, abaxially very sparsely pilose, the hairs fine, whitish, adaxially golden, smooth, shiny; oral setae light yellow, ca. 5 mm long, dense; inner ligule ca. 1 mm long, a thick, dark membrane; outer ligule slightly curved and wider in the middle; blades deciduous, not seen. Normal branch complement with 27–30 branches, these short, thick, 10–22 cm long, with 4–5 leaves before the inflorescence, all other branch complements leafless or with small, broadly lanceolate leaves, 4 cm long, 16–20 mm wide, with flowers only. Branch leaves with sheaths tight, glabrous, broadly carinate, finely transversely rugose, the upper margin finely ciliate; oral setae 7–8 mm long, erect, brownish, sometimes crispate; inner ligule a short, dark membrane; outer ligule an inconspicuous rim; blades long lanceolate, 4–13.5 cm long, 1–2.4 cm wide, L:W = 4–5.6, glabrous, 3–4 lateral nerves on one side with rows of fine prickle hairs, these denser toward the base. Inflorescence spikelike, 8–9 cm long. Spikelets 15–17 mm long, 4 mm wide, pectinate or distichally arranged, some undeveloped spikelets present. Glumes 2, unequal; lower glume 7 mm long, 3 mm wide, finely puberulent, carinate; upper glume 9 mm long, 5 mm wide, lanceolate, glabrous, 9-nerved, finely ciliate toward the apex, the hairs whitish. Both glumes finely dark-spotted adaxially. Lemma 14 mm long, 7 mm wide, lanceolate, glabrous, 18–19-nerved, nerves anastomosing, adaxially dark-spotted, margins ciliate, cilia denser toward the apex. Palea 13–14 mm long, folded, 2.5 mm thick, 10-nerved, all nerves irregular. Rachilla extension 11 mm long, flat, finely pilose, with an inconspicuous rudiment at the apex. Stamens 3; anthers brownish, 11 mm long. Caryopsis not seen.

Phenology. The only available specimen of this species is the type, collected in flower in 1979.

Distribution. Known only from the type locality, state of Rondônia, Brazil.

Merostachys rondoniensis shows a strong affinity with *M. magnispicula* in spikelet morphology. Their spikelets differ in size by just a few millimeters, but the size of their glumes differs. Unfortunately, as complete vegetative organs of both species are not available for study, they cannot be compared vegetatively. Apparently, *M. rondoniensis* was col-

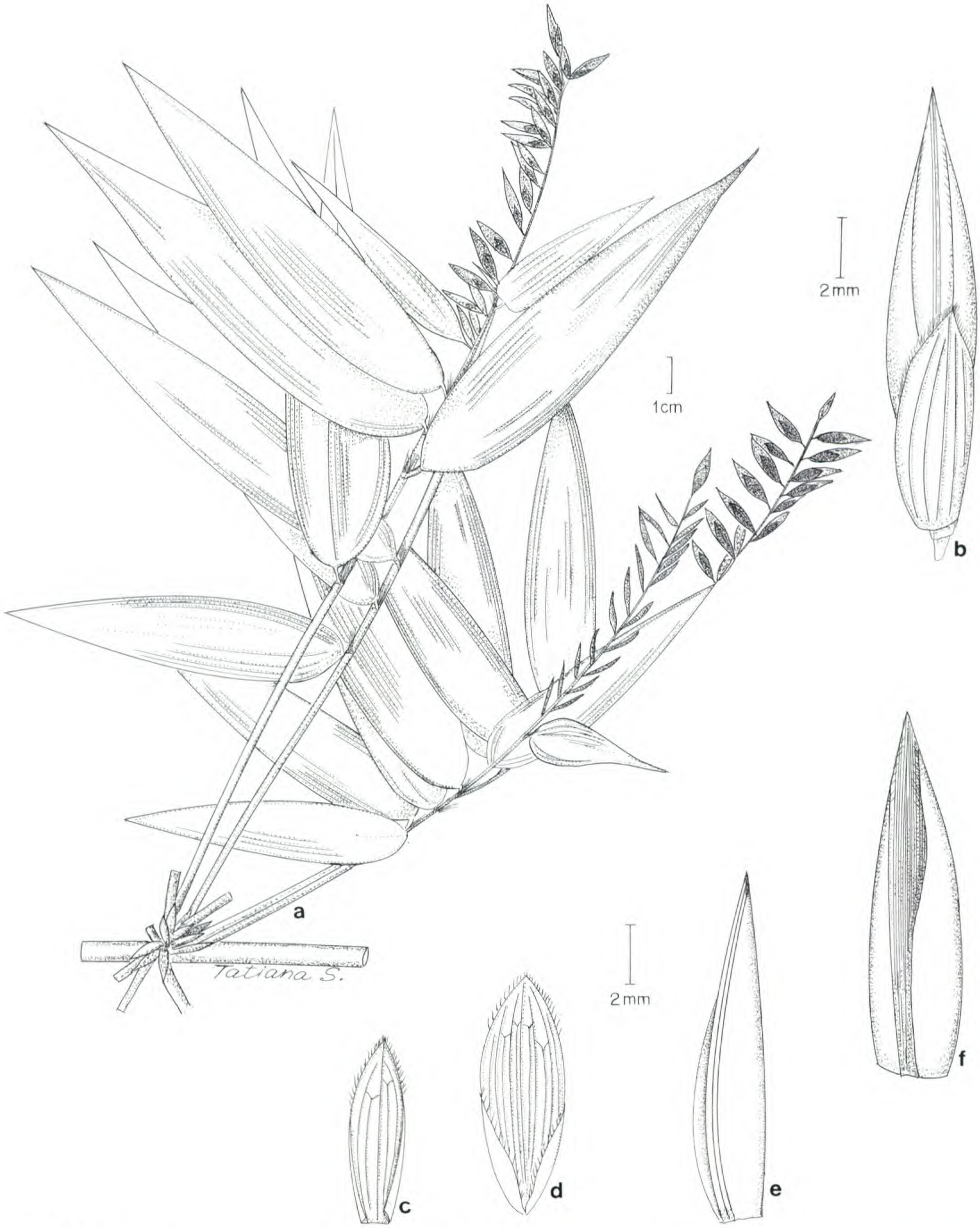

Figure 12. *Merostachys rondoniensis* Sendulsky. —a. Part of the branch complement. —b. Spikelet. —c. Lower glume. —d. Upper glume. —e. Palea. —f. Lemma. Based on *Calderón, Monteiro & Guedes 2780.*

lected under flowering stress; the comparison of the reproductive structures of these species is not entirely reliable, as stress flowering tends to produce abnormal inflorescences and spikelets.

It is hoped that future collections of these species will help to clarify their true affinities.

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Machaerina (Cyperaceae) in South America

Mark T. Strong
Department of Botany, MRC/166, Smithsonian Institution, Washington, D.C. 20560, U.S.A.

ABSTRACT. The genus *Machaerina* Vahl (Cyperaceae) now consists of five species in South America. A key to the taxa, a description of the genus and each taxon, nomenclature, and an illustration of the mature fruit (achene) for each taxon are provided, and the distribution of each taxon is mapped. Two new species, *Machaerina ayangannensis* M. T. Strong from Guyana and *M. austrobrasiliensis* M. T. Strong from southeastern Brazil, are described.

While studying specimens of Cyperaceae for the *Flora of the Guianas* (Guyana, Suriname, and French Guiana), I noted a new species of *Machaerina* Vahl from Guyana. The new species was collected on the summit of Mt. Ayanganna in the Pakaraima mountains by Biodiversity of the Guianas Program, Smithsonian Institution botanists Terry Henkel and Bruce Hoffman. This important discovery initiated a study of other taxa of *Machaerina* occurring in South America, the results of which are presented in this paper.

When Vahl (1805) described *Machaerina*, he based it on a single West Indian sedge, *Schoenus restioides* Swartz (≡ *Machaerina restioides* (Swartz) Vahl). Since then, *Machaerina* and other closely related genera, e.g., *Baumea* Gaudichaud-Beaupré (1829), *Chapelliera* Nees (1834), and *Vincentia* Gaudichaud-Beaupré (1829), have been treated primarily as subgenera or sections in *Cladium* P. Browne (1756), or treated as separate genera. Brown (1810) was one of the first to circumscribe *Cladium* in a broad sense. He described a number of new species of *Cladium* from Australia, some of which have since been referred to *Baumea*, *Gahnia* J. R. & G. Forster, and *Machaerina* sensu lato. Bentham (1878) adopted Brown's earlier treatment of *Cladium* but treated *Baumea* as a section of *Cladium*, placing all the taxa in it except *Cladium mariscus* (L.) Pohl, which he placed in the nominate section. Bentham (1883) later circumscribed *Vincentia* as a section of *Cladium*. Kükenthal (1942) followed Clarke (1894, 1908) in treating *Machaerina* as a subgenus of *Cladium*. He separated *Cladium* into three subgenera (*Cladium*, *Machaerina*, and *Baumea*). Subgenus *Machaerina* was separated from the nominate subgenus *Cladium* by its 2-ranked leaves, 2–6-flowered spikelets, 3 stamens, triquetrous or winged obpyramidal stipe of the achene, and lack of a disc supporting the base of the achene vs. 3-ranked leaves, 1–3-flowered spikelets, 2 stamens, truncate base of the achene, and presence of a disc supporting the base of the achene in subgenus *Cladium*. From the primarily Asian, Australian, and Pacific Island subgenus *Baumea*, he separated subgenus *Machaerina* by its 2–6-flowered spikelets with all flowers fertile, and the stipitate, trigonous, attenuate, wing-angled bases of the achenes vs. 1–3-flowered spikelets with only a single fertile flower, and sessile base of the achene in subgenus *Baumea*. The characters considered by Kükenthal to unite many of the above genera with *Cladium* were the persistent leaf sheaths at the base, the elongated branching of the inflorescence, the shape of the fruit (achene), and the shape of the style base. Other characters that have been used to unite many of the aforementioned genera with *Cladium* (see Kern, 1959, 1974) include the supposedly spiral arrangement of the spikelet scales; usually 1–3-flowered spikelets; usually pubescent style base; and lack of persistent bristles at the base of the achene.

Other authors have treated *Baumea*, *Chapelliera*, *Machaerina*, and *Vincentia* as separate genera. Nees (1834) recognized all these genera as distinct and placed them in his tribe Cladieae Nees ex Fenzl. Endlicher (1836), Kunth (1837), Steudel (1855), and Böckeler (1874) also treated many of these genera as distinct but placed *Machaerina* in the tribe Rhynchosporeae Nees ex Fenzl. Koyama (1956) treated *Vincentia* and *Baumea* (including *Chapelliera*) as sections of *Machaerina*. He later recognized the tribe Cladieae and included in it *Machaerina*, *Cladium*, and *Rhynchocladium* T. Koyama, a northern South American endemic genus (Koyama, 1972). Kern (1974) included *Baumea* and *Vincentia* in *Machaerina* following Koyama (1956), but did not recognize these at either a subgeneric or sectional level, and placed *Machaerina* in the tribe Rhynchosporeae. Lye (1983) and Haines and Lye (1983) treated *Baumea* as a subgenus of *Machaerina* and placed *Machaerina* in the tribe Rhynchosporeae, albeit with some uncertainty. More recent classifications of the Cyperaceae

(Goetghebeur, 1986; Bruhl, 1995) place *Machaerina* in the tribe Schoeneae Dumortier. This tribe includes Cladieae sensu Koyama and a large number of genera primarily restricted to the eastern hemisphere (South Africa, Asia, Australia, and the Pacific region), the tribe Rhynchosporeae being essentially represented only by the primarily American genera *Rhynchospora* and *Pleurostachys*.

Koyama (1956) presented palynological as well as morphological evidence from floral and leaf characters showing that *Cladium* and *Machaerina* were better treated as distinct genera. He characterized species of *Cladium* as having 3-ranked, dorsiventrally compressed, scabrous-margined leaf blades; 2 stamens; pollen of the 1–6 aperture type; and drupelike, corky achenes with inconspicuous style bases, while *Machaerina*, *Baumea*, and *Vincentia* generally possessed 2-ranked, unifacial, terete or bilaterally compressed, smooth-margined leaf blades; 3 stamens; pollen of the polyforate type; and 3-angled, hardened achenes with distinct usually hispid or scaberulous style bases. Kern (1959) pointed out that *Machaerina* species (sensu Koyama) have spikelet scales that are always distichous (2-ranked) and culms [stems] that are pithy or septate in contrast to the spirally arranged (3-ranked) spikelet scales and hollow culms of *Cladium*. Blake (1969) argued further that the structure and morphology of the fruit (achene) of species of *Baumea* were distinct from *Cladium* and *Machaerina*. He showed that the mature fruits (achenes) of species of *Baumea* were unwinged; sessile, rounded or obpyramidal at base; devoid of bristles; and have a thick pericarp, thick hard bony endocarp, spongy or crustaceous usually thick mesocarp, and a thin membranous epicarp. Those of *Machaerina* were shown to have a 3-winged stipitate base; 3-winged or sharply 3-angled style base that is decurrent over the shoulders of the achene body; bristles in some species; a very thin brittle pericarp; and endocarp, mesocarp, and epicarp scarcely distinguishable.

Species of *Machaerina* Vahl sensu stricto (including *Vincentia*) are herein treated as defined by Blake (1969). However, further study of species from the West Indies (to be treated in a separate paper) and possibly others worldwide may indicate that the generic limits defined by Blake (1969) will need to be amended (see discussion of the West Indian taxa). *Machaerina* species can be distinguished from other members of the Cyperaceae by the following combination of characters: 2-ranked leaves; unifacial leaf blades; distichous spikelet scales; triquetrous, 3-winged stipitate base and persistent 3-winged or sharply 3-angled style-base of the achenes, with angles that are whitened or blackened, crinkled, blistered, beset with crystalline fimbrillae or scales, or sometimes antrorsely scabrous; and 6–3 well-developed or reduced and rudimentary bristles at the base of the achene.

Figure 1. Distribution of *Machaerina* in South America. ▲ *M. austrobrasiliensis.* ■ *M. ayangannensis.* ● *M. ensifolia.* ◆ *M. ficticia.* ○ *M. scirpoidea.*

South American species of *Machaerina* are generally plants of upland or montane habitats from 1000 to 2500 m elevation. Three species occur in the Brazilian Region of South America, in mountain ranges of southeastern Brazil (Fig. 1). The other two species are widely separated from the Brazilian plants and occur in different floristic regions. *Machaerina ayangannensis* represents a floristic element of the Guayana Highlands Region of northern South America. However, its affinities to the West Indian species *M. restioides* suggests a floristic connection with the Caribbean Region as well. *Machaerina scirpoidea*, endemic to Isla Más a Tierra, Juan Fernández Islands, Chile, represents an element of the Fernándezian Region. The most significant floristic affinities of this region lie with the Chile-Patagonian Region (extratropical, southern parts of South America including Argentina south to part of the Antarctic peninsula, and southern

Chile), and is included in the Holantarctics, not in the Neotropics (floristic regions after Takhtajan, 1986).

The remaining species of *Machaerina* occurring in the Americas are found in the West Indies, primarily in the Greater Antilles. The widespread *M. restioides* (Swartz) Vahl, which occurs in both the Greater and Lesser Antilles, shares the most affinities with the South American taxa. Shared characteristics include the smooth lenticular to ancipital culms; smooth, wide, ancipital leaf blades; long-stipitate base of the achene; wing-angled achene body; and distinct constriction below the middle of the achene body just above the stipitate base. Three other species were treated by Kükenthal (1942) in *Cladium* subg. *Machaerina* from the Greater Antilles (Cuba and Hispaniola). These three species all differ from *M. restioides* and the South American taxa in having scabrous or scabrous-margined culms and leaf blades; short-stipitate to essentially estipitate achenes; acutely angled achene body (essentially wingless); and a uniform achene body, which lacks a distinct constriction below the middle. The culms and leaf blades of these three species range from being strongly flattened in *M. ekmanii* (Kükenthal) T. Koyama (characteristic of the ancipital culms and blades of *M. restioides*), or somewhat thickened and compressed in *M. cubensis* (Kükenthal) T. Koyama, to broadly lenticular and nearly terete in *M. filifolia* Grisebach. However, these three taxa possess distichous leaves; unifacial, septate-nodulose leaf blades; a three-angled style base with angles bearing trichomes; and persistent bristles at the base of the achene, all characters typical of *Machaerina* sensu stricto. Blake (1969) indicated that the achene carpel structure surrounding the ovary of both *M. ekmanii* and *M. cubensis* is characteristic of other species of *Machaerina* sensu stricto, although he only provided an illustration of the achene of *M. restioides* in longitudinal section. He did not discuss *M. filifolia*, a species that does not entirely fit his circumscription of *Machaerina* sensu stricto, particularly the subterete culms and leaf blades of that species. The extreme differences in some characters, particularly leaf blade and achene characteristics between *Machaerina* species in the West Indies, may indicate that they were not derived from a single ancestor.

The following description of *Machaerina* is based primarily on the South American taxa, but is applicable to species of *Machaerina* sensu stricto worldwide as defined by Blake (1969).

Machaerina Vahl, Enum. Pl. 2: 238. 1806. *Cladium* subg. *Machaerina* (Vahl) C. B. Clarke, in Hooker f., Fl. Brit. India 6: 674. 1894. TYPE: *Schoenus restioides* Swartz ≡ *Machaerina restioides* (Swartz) Vahl.

Trasi P. Beauvois, in T. Lestiboudois, Essai Cypér. 32. 1819. TYPE: not designated.

Vincentia Gaudichaud-Beaupré, in Freycinet, Voy. Uranie: 417. 1829. *Cladium* sect. *Vincentia* (Gaudichaud-Beaupré) Bentham & Hooker f., Gen. Pl. 3: 1066. 1883. *Cladium* subg. *Vincentia* (Gaudichaud-Beaupré) C. B. Clarke, Bull. Misc. Inform. Ser. 8: 124. 1908. TYPE: *Vincentia angustifolia* Gaudichaud-Beaupré ≡ *Machaerina angustifolia* (Gaudichaud-Beaupré) T. Koyama.

Terobera Steudel, Syn. Pl. Glumac. 2: 164. 1855. TYPE: *Terobera scirpoidea* Steudel ≡ *Machaerina scirpoidea* (Steudel) T. Koyama.

Agylla F. Philippi, Anales Univ. Chile 26(1): 643. 1865. TYPE: *Agylla ensifolia* F. Philippi = *Machaerina scirpoidea* (Steudel) T. Koyama.

Large or medium-sized perennials; rhizomes hardened, woody, short or horizontally creeping, often emitting creeping, stout, scaly stolons, 0.5–2 cm thick; sheathing base 8–40 mm wide just above rootstock, the leaves spreading; roots coarse, 1.5–4(–5) mm thick, dark brown to purplish brown. Culms central, solitary, compressed, lenticular to ancipital, frequently channeled along one edge distally, finely or sometimes coarsely ribbed, glabrous. Leaves numerous, 2-ranked, primarily basal, frequently 1–2(–3) reduced cauline ones medially, the upper (3–)5–11 basal ones bearing elongate blades, the lower with blades shorter than the sheaths or wanting; sheaths eligulate, laterally folded, narrowed to summit with an indentation along margins at junction with blade, finely ribbed, septate-nodulose, essentially glabrous; blades unifacial, flattened to ancipital in cross section, linear to linear-falcate, curving to an acuminate tip, finely ribbed, green, glabrous, the margins entire. Inflorescence 1–3 remote to subcontiguous or contiguous, open or contracted, partial panicles; main axes and lateral branches of panicles varying from trigonous to compressed-trigonous or crescentform in cross section, the rachises crescentform, rectangular, or subflattened in cross section, frequently flexuose, ciliate-scabrous to villous on edges, the trichomes frequently extending upward along margins of the short sheathing prophyllar bracts; bracts subtending panicles blade-bearing, the blades rarely exceeding length of subtending panicle, the uppermost ones often with an uncinate apex. Spikelets many, in turbinate or spherical clusters or fascicles of 2–4(–6), or sometimes solitary, laterally compressed, each subtended by a short or barely sheathing prophyllar bract, 2–7-flowered, with 0–4 basal scales empty, the scales distichous or some-

times nearly spirally arranged; scales laterally subcompressed, thin, boat-shaped, keeled, brown to brown-black, purple-black, or black, the margins frequently ciliate. Flowers bisexual; stamens 3, the anthers sagittate at base, basifixed, bilocular, thecae parallel, longitudinally dehiscent, the connective forming an acuminate, lanceolate-subulate appendage at apex; style 3-branched, the stigmatic branches minutely scaly or fimbrillate, ⅓ to ½ length of style. Achenes with a 3-winged, stipitate base and persistent, triquetrous or 3-winged style base, the wings thin and chartaceous or incrassate, decurrent and often with a distinct wire-like margin between base of wing and achene body; achene body globose, obovoid, turbinate, or ellipsoid, often with a constriction (sometimes indistinct) just above the stipitate cellular-reticulate base, faintly rugose or rugulose, finely transversely rugulose or wrinkled, or essentially smooth, the pericarp very thin and brittle; style base triquetrous or 3-winged, triangular to triangular-lanceolate, the angles often whitened or blackened, crinkled and blistered, scabrous, or beset with crystalline fimbrillae or scales; bristles 6–3, subulate or flattened, antrorsely spinulose distally, or often undeveloped and represented only by very short rudiments at base.

KEY TO THE SPECIES OF *MACHAERINA* IN SOUTH AMERICA

1a. Inflorescence contracted, 5–13(–15) cm long (measurement from base of lowest partial panicle (excluding peduncle) to apex of uppermost panicle), 2-–3.5 cm wide; partial panicles of inflorescence essentially contiguous; leaf blades (2.2–)3–11(–12) mm wide; spikelets (7–)8–11 mm long, 2.5–4 mm wide; fertile scales (5.5–)6–10 mm long, (2.5–)2.8–3.8(–4.2) mm wide; achenes 6–9 mm long, 1.5–2 mm wide; achene body ellipsoid to narrowly ellipsoid or ellipsoid-obovoid . . . . . 1. *M. ensifolia*

1b. Inflorescence open, (15–)20–60(–70) cm long (measurement from base of lowest partial panicle (excluding peduncle) to apex of uppermost panicle), (3–)4–10 cm wide; partial panicles of inflorescence remote to subcontiguous; leaf blades (7–)8–25 mm wide; spikelets 4–7 mm long, 1.5–3 mm wide; fertile scales (2.5–)3–6(–6.2) mm long, 1.8–3 mm wide; achenes (2.5–)3–5 mm long, 1–1.3 mm wide; achene body obovoid, ellipsoid-obovoid, ellipsoid-globose, or turbinate.

2a. Spikelets 5–7-flowered; scales dull or sublustrous, minutely antrorsely scabrous-hispid on sides distally; achene wing-angles represented by a series of longitudinal folds and pleats; achene body obovoid to ellipsoid-obovoid, finely transversely rugulose; style base indistinctly triquetrous, shiny, glossy, twisted and wrinkled with transverse or longitudinal folds and pleats that extend down to middle and along angles of achene body, minutely antrorsely scabrous toward apex; bristles 6, variable in length, rarely 1–2 rudimentary ones present; known only from Mt. Ayanganna, Pakaraima Mountains, Guyana . . . . . 2. *M. ayangannensis*

2b. Spikelets 1–3-flowered; scales lustrous, glabrous or sometimes with a few patches of appressed, matted, whitish trichomes on sides distally; achene with essentially plane wing-angles; achene body ellipsoid-globose or turbinate, faintly rugose or rugulose to nearly smooth; style base triquetrous with plane wing-angles, the wing-angles light brown, brown, blackened or whitened, crinkled or blistered, often with minute, crystalline fimbrillae or scales; bristles often undeveloped and represented only by very short rudiments at base, or 1–6 with at least some rudimentary ones present; plants of Juan Fernandez Islands, Chile, and southeastern Brazil.

3a. Sheaths essentially glabrous, only the marginal ribs at the orifice (junction of sheath and blade) bearing appressed trichomes; leaf blades 60–250 cm long; anthers 3–4 mm long; achene body ellipsoid-globose, narrowly winged or wing absent, brown, faintly rugulose with dark brown to blackish rugae; endemic to Isla Más a Tierra, Juan Fernandez Islands, Chile . . . 5. *M. scirpoidea*

3b. Sheaths glabrate, the ribs bearing appressed and matted, whitish or tawny trichomes distally, the marginal ribs tomentulose at the orifice; leaf blades (20–)30–130(–150) cm long; anthers 1.5–3 mm long; achene body turbinate or short-turbinate, distinctly winged, nearly smooth to faintly rugose; plants of southeastern Brazil.

4a. Leaf blades (9–)10–18(–19) mm wide; inflorescence rachises distinctly flexuose; spikelets 2–3-flowered; fertile scales brown-black to purple-black, ovate to oblong-ovate, acute at apex, the midvein ending as a short mucro at apex, rarely prolonged to 0.5 mm long; achene wing-angles whitened to stramineous; achene body faintly rugose; wing-angles of style base crinkled and blistered, sometimes with scattered crystalline fimbrillae or scales distally; bristles essentially absent or represented only by short rudiments at base of achene . . . . . 3. *M. ficticia*

4b. Leaf blades (7–)8–13(–15) mm wide; inflorescence rachises strict or only slightly flexuose; spikelets 1–2-flowered; fertile scales brown, brown-black medially, ovate to ovate-lanceolate, acute to acuminate at apex, the midvein prolonged at apex as a 0.5–1-mm-long awn; achene wing-angles stramineous to light brown, blackened distally along style base; achene body

smooth to obscurely transversely rugulose; wing-angles of style base with crystalline fimbrillae or scales; bristles 1–5(–6), at least 1–2 well-developed persistent bristles present at base of achene, rarely all rudimentary . . . 4. *M. austrobrasiliensis*

1. Machaerina ensifolia (Böckeler) T. Koyama, Bot. Mag. (Tokyo) 69 (812): 63. 1956. *Elynanthus ensifolius* Böckeler, Linnaea 38: 264. 1874. *Cladium ensifolium* (Böckeler) Bentham & Hooker f. ex B. D. Jackson, Index Kewensis: 551. 1895. *Baumea ensifolia* (Böckeler) Palla, Denkschr. Akad. Wien Math.-Nat. 79: 104. 1908. TYPE: Brazil. Province de Rio de Janeiro: Itatiaia, 5 June 1871, *Glaziou 5443* (holotype, B fragment; isotypes, C, K, P). Figure 3A.

Caespitose perennial. Culms (40–)60–180 cm tall, (2–)2.5–5.5 mm wide proximally, very finely ribbed, indistinctly septate-nodulose. Sheaths very finely ribbed, glabrate, indistinctly septate-nodulose, the ribs sometimes bearing appressed, whitish or tawny trichomes and the margins tomentulose near apex, light brown to brown distally, dark brown to purple-black or black proximally, lustrous, with a narrow brown scarious margin; blades narrowly lenticular to flattened, slightly to distinctly falcate, (13–)20–90 cm long, (2.2–)3–11(–12) mm wide, indistinctly septate-nodulose, at least near base. Inflorescence 5–13(–15) cm long (including all partial panicles), 2–3.5 cm wide, of 2–3 contiguous or subcontiguous, contracted panicles from the upper sheathing bracts; panicle branches short, the rachises slightly flexuose, varying from trigonous, rectangular, crescentform or flattened in cross section, ciliate-scabrous on margins. Spikelets solitary or in clusters of 2–4, (7–)8–11 mm long, 2.5–4 mm wide, 4–7-flowered, with 1–3 empty scales proximally; fertile scales ovate to narrowly ovate, short-acuminate at apex, (5.5–)6–10 mm long, (2.5–)2.8–3.8(–4.2) mm wide, dark brown to purple-black or black with reddish brown scarious margins at base, brown medially near apex, lustrous, glabrous, margins short-ciliate, lateral veins indistinct, the midvein prominent distally, antrorsely scabrous to smooth, extending as a short mucro at apex. Anthers 3–5 mm long. Achene (Fig. 3A) 6–9 mm long (including stipitate base and style base), 1.5–2 mm wide (including wing); achene body ellipsoid to narrowly ellipsoid or ellipsoid-obovoid, transversely wrinkled along margins at base of wings, uniformly dark brown, lustrous, 3.5–4.5(–5) mm long (measurements from base of 3-winged stipe to top of achene body, excluding style base), 1.1–1.5 mm wide, distinctly winged, the base stipitate, light brown, triquetrous, wing-angled; style base triquetrous, wing-angled, the angles brown, remotely scabrous distally to essentially smooth, often blackened; bristles absent or rarely a few very short rudimentary ones at base.

Distribution. Southeastern Brazil from the States of southern Minas Gerais and southwestern Rio de Janiero (Serra da Mantiqueira: Mt. Itatiaia) south to eastern São Paulo (Serra da Mantiqueria and Serra da Bocaina), eastern Paraná (Serra do Mar and Serra Putunã), and northeastern Santa Catarina (Serra do Mar).

Habitat. *Machaerina ensifolia* is an element of the Brazilian campo and planalto and occurs in damp soils in swamps, wet meadows, and along streams. On Mt. Itatiaia, in the Parque Nacional do Itatiaia, State of Rio de Janiero, *M. ensifolia* is an element of the planalto vegetation from 2000 to 2400 m elevation. It occurs in moist, dark soils (terra preta) in campestre or along the borders of meadows (várzeas) where it is frequently associated with the grass *Cortaderia modesta* (Doellinger) Hackel (Brade, 1956).

Additional specimens examined. BRAZIL. **Minas Gerais:** 10 Jan. 1876, *Glaziou s.n.* (F). **Paraná:** Mun. Palmeira, Rio dos Papagaios, 15 Dec. 1987, *Cordeiro & Hatschbach 507* (C, MBM, MO); Mun. São José dos Pinhais, Rio Pequeno, 27 Nov. 1969, *Hatschbach & Ravenna 23049* (C, MBM, NY, US), 20 Oct. 1994, *Ribas & Cordeiro 681* (BHCB, MBM). **Rio de Janiero:** *Glaziou 7986* (C, K); Campos de l'Itatiaia, 23 Jan. 1873, *Glaziou 6759* (B fragment, C, K); nos campos da serra do Itatiaia, 2000 m, Mar. 1894, *Ule 232* (R); vicinity of Itatiaia, 26–30 July 1915, *Rose & Russell 20488* (NY, US); Serra do Itatiaia, in campo, ca. 2200 m, July 1901, *Hemmendorf 581* (R); Serra do Itatiaia, in campo, ca. 2600 m, 29 June 1902, *Dusen 647* (US); Serra do Itatiaia, in campo, ca. 2500 m, Nov. 1903, *Moreira 4* (R); Planalto do Itatiaia, 2000 m, May 1926, *Sampaio 4800* (R); vicinity of Macieiras, Mt. Itatiaia, Estação Biologica, ca. 2000 m, 22°26′S, 44°40′W, 10 Dec. 1928, *Smith 1452* (F); Itatiaia, planalto, 2100 m, 26 Feb. 1936, *Brade 15128* (B); Itatiaia, planalto, 2100 m, Jan. 1938, *Burret & Brade 16015* (B); Itatiaia, planalto a 2200–2400 m, 6 Mar. 1962, *Pereira 7070* (F); Parque Nacional do Itatiaia, 1 July 1975, *Camerik 24* (K). **Santa Catarina:** Mun. Campo Alegre, bog, lower fazenda of Ernesto Scheide, Campo Alegre, ca. 900 m, 11 Dec. 1956, *Smith & Klein 8570* (HBR, NY, R, US); Mun. Campo Alegre, slopes of Morro Iquererim, 1500 m, 9–10 Dec. 1956, *Smith & Klein 8548* (HBR, R, US). **São Paulo:** Barreiro Co., Serra da Bocaina, 24 Nov. 1950, *Segadas-Vianna 3057* (R); Serra da Bocaina, estr. S. J. do Barreiro p/Silveiras, km 22, 1780 m, 2 Jan. 1981, *Shepherd & Shepherd 12873* (UEC); Campos do Jordão, Parque Estadual, camino para São José dos Alpes, ca. 2000 m, 20 Nov. 1985, *Pirani et al. 1382* (NY, SPF).

2. Machaerina ayangannensis M. T. Strong, sp. nov. TYPE: Guyana. Cuyuni-Mazaruni Region: Pakaraima Mountains, 2 km transect along summit ridge of Mt. Ayanganna, 05°23′N, 59°59′W, 1800–2000 m, 3 Nov. 1992, *Henkel 138* (holotype, BRG; isotypes, NY, US sheet #3314219). Figure 2.

Differt a *Machaerina restioide* (Swartz) Vahl, antheris 2–2.5 mm longis; acheniis (3.8–)4–4.7(–5) mm longis, 1–1.3 mm latis; corpore achenio subtiliter transverse ruguloso; stylo fundo indistincte triquetro, minute antrorse spinuloso apice, laevi subter, nitido, brunneo, purpureo-nigro distale, torto et rugoso cum tranversis vel longitudinalibus plicis et plicatis extenso deorsum in angulis e corpore achenio.

Caespitose perennial (Fig. 2A). Culms 50–150 cm tall, 6–9 mm wide proximally, channeled on one edge distally, septate-nodulose proximally, finely ribbed. Sheaths essentially glabrous, papillose or papillose-hispid between the ribs distally, septate-nodulose, greenish, brownish, or reddish tinged, with a narrow, brown, scarious margin proximally; blades flattened, slightly falcate, 30–75 cm long, 13–25 mm wide, septate-nodulose. Inflorescence 25–50 cm long (including all partial panicles), 4–10 cm wide, of 2–3 remote to subcontiguous open panicles from the upper sheathing bracts; panicle bracts leaf-like but reduced, often with uncinate apex (Fig. 2B); rachises (Fig. 2C) flexuose, crescentform or subflattened in cross section, ciliate-scabrous on margins. Spikelets (Fig. 2D) solitary or in clusters of 2(–3), 5–6 mm long, 2–3 mm wide, 5–7-flowered, only the prophyll at the base of the spikelet empty; scales ovate to oblong-ovate, acute or sometimes emarginate at apex, 3–5.2 mm long, 1.8–3 mm wide, brown-black to dark purple-black or black, with dark reddish brown scarious margins proximally, dull to sublustrous, minutely antrorsely scabrous-hispid on sides distally, margins ciliate-scabrous, lateral veins indistinct, the midvein prominent, antrorsely scabrous (at least distally), sometimes extending as a very short mucro at apex. Anthers 2–2.5 mm long, the connective prolonged as a reddish, triangular-subulate appendage at apex. Achene (Fig. 2E) (3.8–)4–4.7(–5) mm long (including stipitate base and style base), 1–1.3 mm wide (including wing); achene body obovoid to ellipsoid-obovoid, with convex sides, finely transversely rugulose, with an indistinct constriction just above the stipitate base, 1.8–2 mm long (measurements from base of 3-winged stipe to top of achene body, excluding style base), 1–1.3 mm wide, narrowly winged, brown, the base stipitate, triquetrous, brown, cellular-reticulate; style base indistinctly triquetrous, triangular-lanceolate, minutely antrorsely spinulose toward apex, smooth below, shiny, glossy, brown, purple-black distally, lower ⅔ confluent with achene body, twisted and wrinkled with transverse or longitudinal folds and pleats that extend down to middle and along angles of achene body; bristles 6, variable in length, shorter than to 1 or 2 exceeding achene body, rarely rudimentary.

Distribution. Known only from northern South America, summit of Mt. Ayanganna, Pakaraima Mountains, Guyana.

Habitat. Henkel (1995) characterized the habitat on the summit of Mt. Ayanganna as ". . . dense, boggy 'savanna' . . . on wet organic soils." "Small drainages were thickly shrub filled with *Clusia, Bonnetia,* and other taxa; the large tank bromeliad with attendant *Utricularia humboldtii* occurred here. Occasional *Bonnetia* groves dotted the slopes among the *Brocchinia* bogs." Further information from Henkel's collection notebook describes the habitat as a low sclerophyllous community [with] depression shrub thickets of *Bonnetia* and *Clusia* in organic soils on sandstone. Associated vascular plant species collected by Henkel (series 101–140) and Hoffman (series 3167–3225) include the spermatophytes *Aulonemia sp., Baccharis brachylaenoides* DC., *Bonnetia tepuiensis* Kobuski & Steyermark, *Brocchinia* sp., *Byrsonima* sp., *Chusquea linearis* N. E. Brown, *Clidemia tepuiensis* Wurdack, *Cortaderia roraimensis* (N. E. Brown) Pilger, *Clusia* sp., *Drosera* sp., *Epidendrum dendrobioides* Thunberg, Eriocaulaceae, *Everardia disticha* T. Koyama & Maguire, *Ilex retusa* Klotzsch ex Reissek, *Isidroglavia schomburgkiana* (Oliver) Cruden, *Matalea bolivarensis* Morillo, *Melanea sarmentosa* Aublet, *Meriania crassiramis* (Naudin) Wurdack, *Miconia acutifolia* Ule, *M. tinifolia* var. *roraimensis* Wurdack, *Mikania boomii* Pruski, *Octomeria* sp., *Palicourea obtusata* K. Krause, *Psychotria aubletiana* Steyermark, *Phthirusa* sp., *Rhynchospora roraimae* Kükenthal, *Satyria carnosiflora* Lanjouw, *Stegolepis guianensis* Klotzsch, *Stenopadus megacephalus* Pruski, *Symphonia globulifera* L. f., *Tapeinostemon* sp., *Tococa erythrophylla* (Ule) Wurdack, *Utricularia humboldtii* R. H. Schomburgk, and *Xyris* sp. Associated pteridophytes include *Blechnum proliferum* Rosenstock, *B. stipitellatum* (Sodiro) C. Christ, *Cochlidium attenuatum* A. C. Smith, *C. connellii* (C. H. Wright) A. C. Smith, *Cyathea macrosora* var. *macrosora* (Baker) Domin, *Eriosorus flexuosus* var. *flexuosus* (HBK) Copeland, *E. hispidulus* var. *hispidulus* (Kunze) Vareschi, *Gleichenia bifida* (Willdenow) Sprengel, *G. pennigera* (Martius) T. Moore, *Lindsaea stricta* var. *jamesoniiformis* K. U. Kramer, *L. tetraptera* K. U. Kramer,

Figure 2. *Machaerina ayangannensis* M. T. Strong. —A. Habit. —B. Detail of distal portion of upper inflorescence panicle bract showing uncinate apex. —C. Detail of inflorescence branch showing spikelets. —D. Spikelet. —E. Achene.

Lycopodiella cernua (L.) Pichi Sermolli, *Lycopodium duidae* A. C. Smith, *Pterozonium elaphoglossoides* (Baker) Lellinger, and *Selaginella amazonica* Spring.

Machaerina ayangannensis is most closely related to the West Indian species *M. restioides* (Swartz) Vahl. Shared characteristics include the distinctly flexuose inflorescence rachises, minutely antrorsely

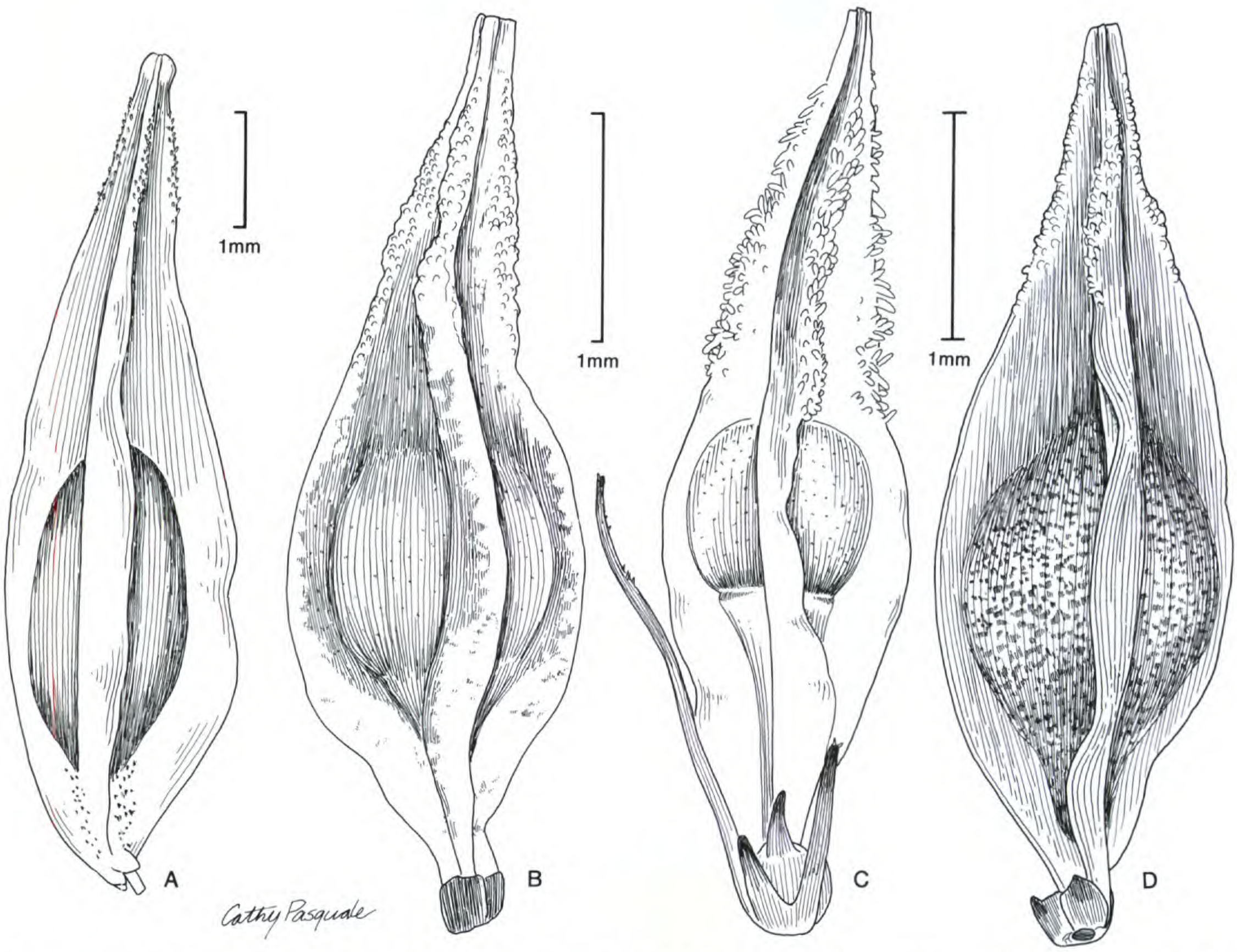

Figure 3. Achenes of four species of *Machaerina* from South America. —A. *M. ensifolia.* —B. *M. ficticia.* —C. *M. austrobrasiliensis.* —D. *M. scirpoidea.* (A from *Ule 232*; B from *Castellanos 23007*; C from *Hatschbach 22776*; D from *Kuschel 82.*)

scabrous-hispid sides of the spikelet scales, and 6, variable in length, persistent bristles at the base of the achene. However, *M. ayangannensis* differs in having anthers 2–2.5 mm long; achenes (3.8–)4–4.7(–5) mm long, 1–1.3 mm wide; finely transversely rugulose achene body; and indistinctly triquetrous, glossy brown to purple-black, minutely antrorsely spinulose distally, twisted and wrinkled style base with longitudinal folds and pleats that extend down to middle and along angles of achene body vs. anthers 1–1.8 mm long; achenes 1.8–2.5 mm long, 0.6–0.9 mm wide; indistinctly rugulose to nearly smooth medially or sometimes venose achene body; and triquetrous, scabrous-hispid style base in *M. restioides.*

3. Machaerina ficticia (Hemsley) T. Koyama, Bot. Mag. (Tokyo) 69 (812): 63. 1956. *Cladium ficticium* Hemsley, Rep. Challenger Bot. part 3: 59. 1884. *Mariscus ficticius* (Hemsley) Fernald, Rhodora 25: 53. 1923. *Machaerina scirpoidea* subsp. *ficticia* (Hemsley) T. Koyama, Mem. New York Bot. Gard. 23: 89. 1972. TYPE: Brazil. Province de Rio de Janeiro: haut des Orgães, 23 Oct. 1872, *Glaziou 6421* (lectotype, selected here, K; isolectotypes, B fragment, NY, P). Figure 3B.

Vincentia macrophylla Böckeler, Allg. Bot. Z. Syst. 2: 112. 1896. *Cladium ficticium* var. *macrophyllum* (Böckeler) Kükenthal, Repert. Spec. Nov. Regni. Veg. 51: 143. 1942. *Machaerina* macrophylla (Böckeler) T. Koyama, Bot. Mag. (Tokyo) 69 (812): 64. 1956. TYPE: Brazil. Province de Rio de Janeiro: haut des Orgães, 6 Mar. 1889, *Glaziou 17861* (holotype, B fragment; isotypes, C, K, P).

Caespitose perennial. Culms (30–)50–150 cm tall, 4–8(–9) mm wide proximally, finely ribbed. Sheaths septate-nodulose, glabrous or the ribs bearing appressed and matted, whitish or tawny trichomes distally and the margins tomentulose near summit, green distally, brown to dark brown proximally, with a brown to dark brown, narrow, scarious band on margin proximally; blades slightly falcate, (20–)30–130(–150) cm long, (9–)10–18(–19) mm wide, indistinctly septate-nodulose. Inflorescence (15–)20–60(–70) cm long (including all par-

tial panicles), 4–8(–9) cm wide, of 2–3 remote to subcontiguous open panicles from the upper sheathing bracts; rachises flexuose, ciliate-scabrous to villous on margins. Spikelets solitary or in clusters of 2–3, 5–7 mm long, 1.8–2.5 mm wide, 2–3-flowered, the scales distichous, 5–7, spreading at maturity, the lowermost 3–4 empty; fertile scales ovate to oblong-ovate, acute at apex, (2.5–)3–5 (–5.5) mm long, 1.8–3 mm wide, brown-black to purple-black with reddish brown scarious margins proximally, lustrous, essentially glabrous, sometimes with a few patches of appressed, matted, whitish trichomes on sides distally, margins ciliate or entire, lateral veins indistinct, the midvein prominent, extending as a short mucro at apex, rarely prolonged as a short (to 0.5 mm long) awn. Anthers 1.5–2.5(–3) mm long. Achene (Fig. 3B) (3.0–)4–5 mm long (including stipitate base and style base), 1–1.3 mm wide (including wing), wing-angled, the wing-angles whitened to stramineous; achene body short-turbinate with a distinct constriction just above the stipitate base, 2–2.2 mm long (measurements from base of 3-winged stipe to top of achene body, excluding style base), (0.7–)0.8–1.2(–1.3) mm wide, brown to reddish brown or grayish black, faintly rugose, narrowly winged, the base stipitate, 3-winged; style base triquetrous, triangular-lanceolate, wing-angled, brown, the wing-angles thickened, whitened proximally, rarely blackened, crinkled and blistered, often with scattered, minute, crystalline fimbrillae or scales distally; bristles essentially absent or sometimes a few very short rudimentary ones at base.

Distribution. Southeastern Brazil from the State of southeastern Minas Gerais (Serra do Caparaó) south to the State of Rio de Janiero (Serra dos Órgãos).

Habitat. Moist soils in meadows and openings; 1400–2400 m elevation.

Luetzelburg (1923) listed *Cladium ensifolium* H. Pfeiffer as occurring in the Serra dos Órgãos, Isabelloca, 2000 m, and Serra da Estrella, Frade, 1500 m (both localities of which are just northwest of the city of Rio de Janiero, Brazil), and cited *Agylla ensifolia* F. Philippi as a synonym. However, *A. ensifolia* is a synonym of *Machaerina scirpoidea* (Steudel) T. Koyama, a plant endemic to Isla Más a Tierra, Juan Fernández Islands, Chile. Pfeiffer and Palla were given credit by Luetzelburg for making the determinations of Cyperaceae for his list of collections from Brazil. The determination on the specimen label of *Luetzelburg 6852* (M) is *Cladium ensifolium* H. Pfeiffer, an apparent transfer of *Agylla ensifolia* to *Cladium* proposed by Pfeiffer. However, the plant on the sheet is a specimen of *Machaerina ficticia* (Hemsley) T. Koyama, a species that is well documented from Serra dos Órgãos, State of Rio de Janiero, Brazil. It is not clear why Pfeiffer made a transfer of *Agylla ensifolia* F. Philippi to *Cladium* in 1923 when the name *Cladium scirpoideum* (based on *Terobera scirpoidea*), a plant that had been previously documented both by Böckeler (1874) and Hemsley (1884) as being conspecific with *Agylla ensifolia*, was available.

This plant has frequently been placed infraspecifically with *Machaerina scirpoidea.* When Böckeler (1874) made a transfer of Steudel's *Terobera scirpoidea* to *Vincentia*, he included Brazil within the range of *Vincentia scirpoidea* (Steudel) Böckeler, citing an unspecified collection of Glaziou, most likely either the type of, or one of the collections cited herein for, *M. ficticia.* Koyama (1972) accepted this, placing *M. ficticia* at the rank of subspecies (*Machaerina scirpoidea* subsp. *ficticia* (Hemsley) T. Koyama). *Machaerina ficticia* does show some relationship with *M. scirpoidea*, particularly the leaf sheaths and blades. However, it differs from *M. scirpoidea* in having distinctly flexuose inflorescence rachises; spikelet scales short-mucronate at apex, the mucro rarely prolonged to 0.5 mm long; anthers 1.5–2.5(–3) mm long; achene wing-angles whitened to stramineous; and achene body (including stipitate base) turbinate or short-turbinate, the surface faintly rugose vs. strict or slightly flexuose inflorescence rachises; spikelet scales with 0.5–1-mm-long awns; anthers 3–4 mm long; achene wing-angles brown; and ellipsoid-globose achene body of *M. scirpoidea.*

A specimen from Rio Grande do Sul, Cambará, p. S. Francisco de Paula, collected 18 Feb. 1955 by *Rambo 56824* (B) (not mapped), is referable to *Machaerina ficticia.* The achenes and flexuose inflorescence rachises of this specimen are similar to *M. ficticia.* However, this collection represents a 1200–1400-km disjunction to the south from the center of distribution of this species in the States of southeastern Minas Gerais and Rio de Janiero. Rambo noted (on the specimen label) that this collection was a "species in RGS (Rio Grande do Sul) semel solum inventa." Additional collections of this plant are needed before a determination can be made of its relationships with other species of *Machaerina* in southeastern Brazil and whether it might represent a new taxon.

Additional specimens examined. BRAZIL. **Minas Gerais:** Serra do Caparaó, Cachoeira da Fumaça, 1900 m, 1 Oct. 1941, *Brade 17053* (B). **Rio de Janiero:** haut des Órgães, 8 Aug. 1869, *Glaziou 3617* (C, K, P, US); Theresópolis, Pedra-Assu, Campo das Antas, 2000 m, 30

Sep. 1929, *Brade 9497* (B, F, R); Sta. Magdalena, Pedra Dubois, 1200 m, May 1934, *Lima 240* (B); Serra dos Órgãos, Morro Assu, 2400 m, June 1916, *Luetzelburg 6852* (M, NY); Serra dos Órgãos, Centralstock, (Staat Rio), 2000 m, June 1916, *Luetzelburg 7230i* (M); Serra dos Órgãos, Cachoeira do Riacho Frio, 1400 m, 23 Aug. 1940, *Brade 16615* (R); Serra dos Órgãos, Campo das Antas, 2100 m, 31 Aug. 1940, *Brade 16516* (MO); Serra dos Órgãos, Abrg. 4, 19 Oct. 1958, *Emmerich 136* (R); Theresópolis, Parque Nacional Serra dos Órgãos, Campo das Antas, 9 Dec. 1960, *Castellanos 23007* (F, NY); Parque National Serra dos Órgãos, Pedra da Balboa, 2000 m, 20 Dec. 1972, *Vidal II-5714* (NY, R); Mun. Petrópolis, entre Araras e Vale das Videiras, Morro do Cuca, Pico do Pindoba, 1600 m, 2 June 1984, *Martinelli et al. 9885* (NY).

4. Machaerina austrobrasiliensis M. T. Strong, sp. nov. TYPE: Brazil. Paraná: Mun. Campina Grande do Sul, Serra do Capivari Grande, alt. 1500 m, *Hatschbach 22776* (holotype, MBM; isotypes, C, F, MO). Figure 3C.

Differt a *Machaerina ficticia* (Hemsley) T. Koyama, laminis foliorum (7–)8–13(–15) mm latis; rhachidibus inflorescentiis strictis vel leviter flexuosis; spiculis 1–2-floribus; squamis fertilibus brunneis, brunneo-nigris in mediis, ovatis ad ovatolanceolatas, acutis ad acuminatas ad apices, nervo medio prolongato ad apicem pro arista 0.5–1 mm longa; alatoangulis acheniis stramineis ad palida brunnea, denigratis distalibus in stylo base; corpore achenio laevi ad obscure transverse rugulosum; alatoangulis stylis praeditis crystallinis fimbrillis vel squamis; setis 1–5(–6), saltem 1–2 bene-evolutis et persistentibus basibus acheniis, raro totis rudimentis.

Caespitose perennial. Culms (25–)40–90(–100) cm tall, 3–5(–5.5) mm wide proximally, finely ribbed. Sheaths glabrous or the ribs bearing appressed and matted, whitish or tawny trichomes distally and the margins tomentulose near summit, green distally, light brown to brown proximally, with a brown to dark brown, narrow, scarious band on margin proximally; blades slightly falcate, (20–)30–80(–100) cm long, (7–)8–13(–15) mm wide, indistinctly septate-nodulose (at least proximally). Inflorescence (15–)20–50 cm long (including all partial panicles), (3.5–)4–8(–10) cm wide, of 2–3 remote to subcontiguous open panicles from the upper sheathing bracts; rachises strict or slightly flexuose, crescentform to flattened in cross section, the margins glabrate, ciliate-scabrous at the nodes. Spikelets solitary or in clusters of 2–3, 4–6 mm long, 1.5–2.5 mm wide, 1–2-flowered, the scales 5–7, distichous, spreading at maturity, the lowermost 2–5 empty; fertile scales ovate to ovate-lanceolate, acute to acuminate at apex, 4–6 mm long, 1.8–2.3 mm wide, essentially glabrous, sometimes with a few patches of appressed, matted, whitish trichomes on sides distally, brown to brown-black medially, with reddish brown scarious margins, lustrous, margins ciliate or rarely entire, lateral veins indistinct, the midvein prominent, prolonged as a 0.5–1-mm-long awn. Anthers 2–3 mm long. Achene (Fig. 3C) (2.5–)3–4.2 mm long (including stipitate base and style base), 1–1.3 mm wide (including wing), wing-angled, the wings 0.2–0.3 mm broad along achene body; achene body turbinate with a distinct constriction just above the stipitate base, 2–2.5 mm long (measurements from base of 3-winged stipe to top of achene body, excluding style base), 0.6–0.8 mm wide, stramineous to light brown, nearly smooth to obscurely transversely rugulose, the base stipitate, 3-winged; style base triquetrous, triangular-lanceolate, wing-angled, stramineous to light brown, the wing-angles thickened, lustrous, dark brown to brown-black, with minute crystalline fimbrillae or scales; bristles 1–5(–6), 1–2 equaling to exceeding the achene, some very short and rudimentary at base, rarely all rudimentary, smooth to antrorsely scabrous above middle.

Distribution. Southeastern Brazil from the State of eastern Paraná (Serra do Mar) south to southeastern Santa Catarina (Serra do Oratório and Serra Geral) and northeastern Rio Grande do Sul (Serra Geral).

Habitat. In damp soils and marshy places of campo rupestre and planalto, on steep slopes of hillsides, margins of creeks, and steep rock outcrops along rivers and ravines, 1000–2000 m elevation.

Barros (1960) referred one of the specimens cited below (*Reitz & Klein 7165*) to *Cladium ficticium* var. *macrophyllum* (Böckeler) Kükenthal. However, the type of *Vincentia macrophylla* Böckeler (*Glaziou 17861*) is conspecific with *Machaerina ficticia.*

Paratypes. BRAZIL. **Paraná:** Mun. Campina Grande do Sul, Pico Caratuva, 1950 m, 6 Oct. 1967, *Hatschbach 19925* (MBM, US); Mun. Campina Grande do Sul, Serra Ibitiraquire, Abrigo 1, 1600 m, 25 Sep. 1969, *Hatschbach 22207* (MBM, MO); Mun. Campina Grande do Sul, Serra Ibitiraquire, trilha ao Pico Serra do Paraná, Pouso da Sorte, 17 June 1973, *Imaquire 1000* (MBM); Mun. Campina Grande do Sul, Serra do Capivari Grande, 1200 m, 18 July 1986, *Cordeiro & Zelma 310* (MBM, US); Mun. Campina Grande do Sul, Serra do Capivari Grande, 1300 m, 24 Aug. 1989, *Nicolack & Cordeiro 127* (MBM, US); Mun. Guaratuba, Serra de Araçatuba, 1300 m, 22 Nov. 1959, *Hatschbach 6525* (MBM); Mun. Guaratuba, Serra do Araçatuba, 1300 m, 15 Sep. 1982, *Kummrow 2026* (MBM). **Rio Grande do Sul:** Mun. Cambara do Sul–Fortaleza, 1050 m, 27 Sep. 1992, *Wasum et al. 8679* (US). **Santa Catarina:** Mun. Bom Jardim da Serra, Serra do Oratório, São Joaquim, 1500 m, 18 Sep. 1958, *Reitz & Klein 7165* (HBR, NY, US); Mun. Bom Jardim da Serra, headwaters of Rio Capivari, 17 Dec. 1971, *Smith & Klein 15861* (R, US); Mun. Bom Jardim da Serra, Desfiladeiro do Funil, Jan. 1986, *Sobral et al. 4854* (NY); Mun. Bom Jardim da Serra, Serra do Rio do Rastro, 1200 m, 8 Nov. 1986, *Falkenberg & Souza 3991* (MBM); Mun. Lauro Müller, Serra

do Rio do Rastro, 18 Apr. 1994, *Hatschbach & Barbosa 60643* (MBM).

5. Machaerina scirpoidea (Steudel) T. Koyama, Bot. Mag. (Tokyo) 69 (812): 65. 1956. *Terobera scirpoidea* Steudel, Syn. Pl. Glumac. 2: 164. 1855. *Vincentia scirpoidea* (Steudel) Böckeler, Linnaea 38: 250. 1874. *Cladium scirpoideum* (Steudel) Bentham & Hooker f. ex Hemsley, Rep. Challenger Bot. part 3: 59. 1884. *Mariscus scirpoideus* (Steudel) Kuntze, Revis. Gen. Pl. 2: 755. 1891. TYPE: Chile. Juan Fernández Islands: scirpoidea mihi ignota, ad rupium fissuras in frigidis rusticum editiorum, Apr. 1830, *Bertero 1509* (holotype, P). Figure 3D.

Agylla ensifolia F. Philippi, Anales Univ. Chile 26 (1): 643. 1865. *Cladium ensifolium* (F. Philippi) H. Pfeiffer, in Luetzelburg, Estud. Bot. Nordéste 126. 1923. TYPE: Chile. Juan Fernández: Nov. 1864, *Philippi s.n.* (holotype, SGO).

Caespitose perennial. Culms 50–150 cm tall, 4–6 mm wide proximally, channeled on one edge distally, smooth, finely ribbed, glabrous or sometimes a few crystalline trichomes scattered along the ribs. Sheaths minutely punctate between the ribs abaxially (at least distally), indistinctly septate-nodulose, glabrous, green distally, brown to dark brown proximally, with a brown to dark brown narrow scarious band on margin proximally; blades slightly falcate, 60–250 cm long, (7–)8–18(–19) mm wide, indistinctly septate-nodulose. Inflorescence 20–50 cm long (including all partial panicles), 3–9(–10) cm wide, of 2–3 remote to subcontiguous open panicles from the upper sheathing bracts; rachises strict or only slightly flexuose, crescentform or flattened in cross section, ciliate-scabrous on margins. Spikelets solitary or in clusters of 2–3, 6–7 mm long, 2–2.5 mm wide, 2–3-flowered, the scales 4–5, distichous, spreading at maturity, the lowest 1–2 empty; fertile scales ovate to ovate-lanceolate, acute to short-acuminate at apex, 4.5–6(–6.2) mm long, 1.8–3 mm wide, dark brown to dark brown-black with dark brown to dark reddish brown scarious margins proximally, lustrous, essentially glabrous, sometimes with a few patches of appressed, matted, whitish trichomes on sides distally, margins entire or ciliate, lateral veins indistinct, the midvein prominent distally, prolonged at apex as a 0.5–1-mm-long awn. Anthers 3–4 mm long. Achene (Fig. 3D) 3.5–4.5 mm long (including stipitate base and style base), 1–1.3 mm wide (including wing); achene body ellipsoid-globose with a constriction just above the stipitate base, 1.8–2.3 mm long (measurements from base of 3-winged stipe to top of achene body, excluding style base), 1–1.2 mm wide, narrowly winged or wing absent, brown, faintly rugulose with dark brown to blackish rugae, the base stipitate, 3-winged; style base triquetrous, triangular-lanceolate, wing-angled, brown, the wing-angles thickened, crinkled and blistered; bristles absent or rarely a few very short rudimentary ones at base.

Distribution. Known only from Isla Más a Tierra, Juan Fernández Islands off the west coast of Chile. Luetzelburg (1923) cited *Cladium scirpoideum* Hemsley as occurring in the Serra dos Órgãos, Açú, 2300 m, in his list of species and families collected during his travels in Brazil. Palla and Pfeiffer were cited by Luetzelburg as doing the determinations of Cyperaceae for this list. It is most likely that one of these authorities (probably Pfeiffer) followed Böckeler's (1874) circumscription of this species, which included Glaziou's collections of *Machaerina ficticia* from Serra dos Órgãos.

Habitat. Wet or swampy ground along streams, or hanging over rocks in and bordering the summit of waterfalls, 183–630 m elevation. Johow (1896) recorded *M. scirpoidea* as occurring at Pangal (Pangal Falls) and in the border of the estuary that surrounds the Plazuela del Yunque.

Additional specimens examined. CHILE. **Juan Fernández Islands:** *Philippi 27* (B fragment); Feb. 1876, *Moseley s.n.* (K); Isla Más a Tierra, Cordón Salsipuedes, 630 m, 8 Dec. 1916, *Skottsberg & Skottsberg 72* (B, K, US); Isla Más a Tierra, in the gap between Yunque and Damajuine, 600 m, 8 Dec. 1916, *Skottsberg & Skottsberg 163* (C, NY); 1923, *Tenz 14* (B); Isla Más a Tierra, en las paredes de la caida de aqua en el Pangal, 27 Feb. 1936, *Espinosa s.n.* (SGO); Isla Más a Tierra, Corrales de Molina, 9 Jan. 1955, *Kuschel 82* (C, NY, US); Isla Más a Tierra, Salto de Pangal, in the waterfall, ca. 220 m, 22 Sep. 1955, *Sparre & Planella 144* (K, US); Isla Más a Tierra, S-Hang des Yunque, 560 m, 1 Feb. 1962, *Kubitzki 212* (M); Isla Más a Tierra, Pangal Falls, ca. 183 m, 18 Dec. 1965, *Meyer 9596* (K, MO); Isla Más a Tierra, Quebrada de Villagra, Salto de La Pulga, 445 m, 28 Jan. 1980, *Marticorena et al. 9035* (M).

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at HBR, and the curators of B, BHCB, C, F, M, MBM, MO, NY, R, SGO, SPF, and UEC for the loan of specimens and/or information regarding this study.

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Encalypta tianschanica (Musci: Encalyptaceae), a New Species from Western China, with a Key to the Species of *Encalypta* in Xinjiang

Jian-cheng Zhao
Department of Biology, Hebei Normal University, Shijiazhuang 050016, China

Si He
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

Ren-liang Hu
Department of Biology, East China Normal University, Shanghai 200062, China

ABSTRACT. *Encalypta tianschanica*, a new Chinese endemic from Xinjiang province, is described, illustrated, and compared with *E. buxbaumioidea* T. Cao, C. Gao & X.-L. Bai, an Inner Mongolian endemic that has narrowly pyriform capsules and a strongly excurrent costa. The new species is distinguished by its ovoid capsules, which are abruptly contracted to a very small mouth, and by its costa ending well below the leaf apex. The presence of distally "warty" spores places the new species in section *Rhabdotheca* C. Müller. A key to the six species of *Encalypta* Hedwig in Xinjiang is included.

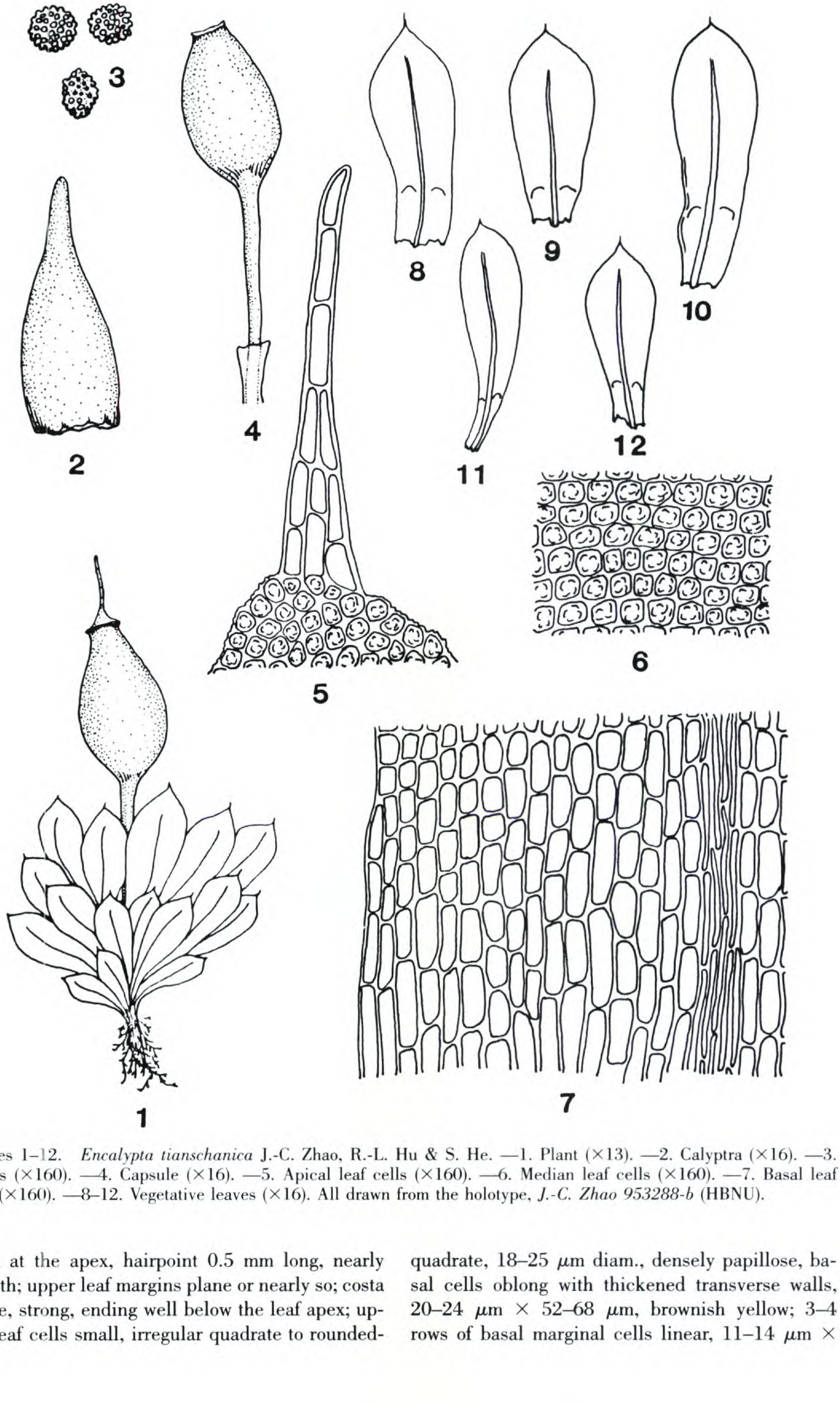
While working through our bryophyte collections made in Xinjiang Urgur Autonomous Region (Xinjiang), we encountered an interesting moss that belongs to *Encalypta*. This discovery has led us to present the following discussion on the genus.

The genus *Encalypta* is characterized by a prominent and usually persistent, campanulate, non-plicate calyptra covering the whole capsule, by quadrate upper leaf cells that are obscure with dense papillae, and by elongate basal leaf cells that are often reddish with markedly thickened transverse walls. The species of *Encalypta* are predominantly distributed in the Northern Hemisphere, where they are characteristic components of northern and montane vegetation. In a world-wide revision of the Encalyptaceae, Horton (1982, 1983) accepted 19 species and 4 subspecies in *Encalypta*. Six or seven species were recognized from China by T. Cao et al. (1992) and T. Cao and C. Gao (1996), respectively, although Redfearn et al. (1996) listed eleven species of *Encalypta* from China. *Encalypta sibirica* (Weinmann) Warnstorf was reported as new to China by Horton (1983), but it was not included in T. Cao and C. Gao (1996). The latter study, however, includes two previously untreated species, *Encalypta spathulata* C. Müller and *E. vulgaris* Hedwig, by T. Cao et al. (1992). Tan et al. (1995) reported five species of *Encalypta* from Xinjiang. Unlike other Chinese species, which tend to have excurrent or at least percurrent costae and cylindric or pyriform capsules that are not contracted or only gradually contracted to a small mouth, the new collection we made in the Tianshan Mountains has costae ending well below the leaf apex and ovoid capsules that are abruptly contracted to a small mouth. This moss does not match any of the species already described from China (T. Cao et al., 1992; T. Cao & C. Gao, 1996), nor is it identical to any other species of *Encalypta* reported for Xinjiang (Tan et al., 1995). It is described below as a new species.

Encalypta tianschanica J.-C. Zhao, R.-L. Hu & S. He, sp. nov. TYPE: China. Xinjiang: Tianshan Mountain Range, Guongnes forest station, near Guongnes river, 43°15′N, 84°45′E, *J.-C. Zhao 953288-b*, 30 July, 1995 (holotype, HBNU; isotypes, HSNU, MO). Figures 1–12.

Plantae *Encalyptae buxbaumioideae* T. Cao, C. Gao et X.-L. Bai similis. Differt ab *E. buxbaumioidea* foliis et capsulis. Folia obtusa vel late rotunda, costa supene angusta, longe infra apiceum folii evanida. Capsula ovoidea vel ovato-oblonga, symmetrica, ca. 1.7–1.9 mm longa et ca. 1.0–1.11 mm crassa.

Plants small, to 6–8 mm tall, green to yellowish green above, bright brown below, in dense tufts. Stems simple or sparsely branched; central strand indistinct. Leaves slightly tortuose when dry, erect-spreading when moist, 2.2–3.5 mm long, obovate or spatulate, abruptly narrowed to a hyaline hair-



Figures 1–12. *Encalypta tianschanica* J.-C. Zhao, R.-L. Hu & S. He. —1. Plant (×13). —2. Calyptra (×16). —3. Spores (×160). —4. Capsule (×16). —5. Apical leaf cells (×160). —6. Median leaf cells (×160). —7. Basal leaf cells (×160). —8–12. Vegetative leaves (×16). All drawn from the holotype, *J.-C. Zhao 953288-b* (HBNU).

point at the apex, hairpoint 0.5 mm long, nearly smooth; upper leaf margins plane or nearly so; costa single, strong, ending well below the leaf apex; upper leaf cells small, irregular quadrate to rounded-quadrate, 18–25 μm diam., densely papillose, basal cells oblong with thickened transverse walls, 20–24 μm × 52–68 μm, brownish yellow; 3–4 rows of basal marginal cells linear, 11–14 μm ×

45–58 μm, thin-walled, pale in color. Autoicous. Perichaetial leaves the same as or slightly smaller than the upper stem leaves. Setae very short, 1.5–1.7 mm long, erect or slightly inclined, brownish yellow; capsules ovoid, smooth, suddenly contracted from a broad base to a very small mouth; peristome absent; annuli undifferentiated; opercula low conic-rostrate, with a long, slightly oblique beak; calyptrae covering the whole capsules, smooth, often ragged at base, with an obtuse rostrum, ca. ⅓ the calyptra length. Spores 38–45 μm diam., heteropolar, with large, verrucate protuberances (warty papillae) on the distal surface, radially plicate on the proximal surface.

Habitat. On soils at base of trees under *Picea schrenkiana* forest; altitude 2000 m.

Encalypta tianschanica is named after Tianshan, the largest mountain in the central part of Eurasia. The new species is notable for its distally "warty" spores, which clearly place it in section *Rhabdotheca* (Horton, 1983: 413–414). Among the species in the section, *E. tianschanica* is similar to *E. buxbaumioidea* and *E. spathulata* in having hyaline hair-pointed leaves, undifferentiated annuli, and no peristome teeth (T. Cao & C. Gao, 1990). Between the two related species, *Encalypta tianschanica* appears closest to *E. buxbaumioidea* since both have very short setae (less than 2.0 mm long) and share peculiarly shaped capsules that are gasterpodous and become contracted to a small mouth. It differs from the latter species by its ovoid capsules that are abruptly contracted to a small mouth, by its costa ending well below the leaf apex, and by its upper leaf margins that are plane or nearly so. In *Encalypta buxbaumioidea*, however, the capsules are narrowly pyriform and gradually contracted to a small mouth, the costa is excurrent in a rather long awn, and the upper leaf margins are distinctly incurved.

Key to the Species of *Encalypta* in Xinjiang

1. Spores nearly smooth on the distal surface . . 2
1′. Spores with large, verrucate protuberances on the distal surface 3
2(1). Peristome absent; upper leaves gradually tapered to narrowly acute or stoutly apiculate at the apex; calyptrae with a shorter rostrum, ca. ¼–⅓ the calyptra length . . . . . *E. alpina* Smith
2′. Peristome present; upper leaves ± abruptly narrowed and mucronate at the apex; calyptrae with a longer rostrum, ca. ½ the calyptra length . . . . . *E. ciliata* Hedwig
3(1). Capsules ovoid, smooth, abruptly contracted to a small mouth; costa ending well below the leaf apex . . . . . *E. tianschanica* J.-C. Zhao, R.-L. Hu & S. He
3′. Capsules cylindric to elliptic-cylindric, furrowed, only slightly contracted below the mouth; costa excurrent or percurrent 4
4(3). Peristome teeth well developed; annuli differentiated . . . . . *E. rhaptocarpa* Schwaegrichen
4′. Peristome absent or vestigial, white to hyaline; annuli undifferentiated 5
5(4). Leaf apex hair-pointed; costa excurrent; calyptrae pale-golden and transparent, fringed at the base . . . . . *E. spathulata* C. Müller
5′. Leaf apex often muticous or apiculate; costa percurrent; calyptrae golden brown and translucent, fringe absent . . . . . *E. vulgaris* Hedwig

Specimens examined. CHINA. **Inner Mongolia:** (*Encalypta buxbaumioidea*), Haunggangliang forest centre, Keshike Qi (Banner) near Chifeng City, 21. X. 1985, *X.-L. Bai 70* (holotype, Dept. of Biol., Univ. of Inner Mongolia; isotype, IFSBH). **Xinjiang:** (*E. alpina*), Mt. Bogda, near Tian-chi, *J.-C. Zhao 2234, 2831-b* (XJU), *K.-J. Guan 4375* (PE); Fukang Co., *J.-C. Zhao 3185* (XJU); Miquan Co., *J.-C. Zhao 99* (XJU). (*E. ciliata*), Mt. Tianshan, Tianchi, 2300–2500 m, *J.-C. Zhao 2869, 2955, 3010* (XJU). (*E. rhaptocarpa*), Mt. Tianshan, Tianchi, *J.-C. Zhao 3281, 2808* (XJU); Miquan Co., *J.-C. Zhao 17* (XJU). (*E. spathulata*), Mt. Bogda, 3300 m, grassland, *J.-C. Zhao 2258-a* (XJU); Miquan Co., *J.-C. Zhao 4229* (XJU); Urumqi Co., *J.-C. Zhao 3171-b* (XJU). (*E. vulgaris*), Mt. Altai, *J.-C. Zhao 1669* (XJU); Mt. Bogda, *J.-C. Zhao 4709, 4514-b* (XJU).

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A Synopsis of *Arabidopsis* (Brassicaceae)

Steve L. O'Kane, Jr.
Department of Biology, University of Northern Iowa, Cedar Falls, Iowa 50614-0421, U.S.A.

Ihsan A. Al-Shehbaz
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. New combinations in *Arabidopsis* are proposed. Species previously placed in *Cardaminopsis* are here transferred to *Arabidopsis* and taxa previously recognized in *Arabidopsis*, other than *A. thaliana* and *A. suecica*, are excluded from the genus. Distributions and a key to the nine species and five subspecies are presented.

Based on analyses of rDNA sequences, the genus *Arabidopsis* as understood prior to this study is not only highly paraphyletic but also includes taxa that are distant in the Brassicaceae (unpublished results). This situation is particularly alarming given the central place that *A. thaliana* (L.) Heynhold plays in a myriad of current studies of genome evolution, developmental genetics, morphological evolution and development, etc. (Meyerowitz & Pruitt, 1985; Endress, 1992; Maluszynska & Heslop-Harrison, 1993; Crone & Lord, 1994; Larkin et al., 1994; Price et al., 1994; Teutonico & Osborn, 1994; Zhang & Lechowica, 1994; Tsukaya, 1995). Without a well-documented phylogenetic reconstruction of the genus and a congruent taxonomy, studies that make assumptions about its relations are likely to be inconclusive and to arrive at irrelevant conclusions. A number of recent studies (e.g., Maluszynska & Heslop-Harrison, 1993; Kamm et al., 1995; Tsukaya et al., 1997) have assumed close relationships between *A. thaliana* and species currently included in the genus that molecular data do not support (Price et al., 1994; O'Kane et al., 1995). The genus has been variously placed close to several other genera (*Arabis*, *Braya*, *Cardaminopsis*, *Cymatocarpus*, *Drabopsis*, *Halimolobos*, *Hylandra*, *Microsisymbrium*, *Nasturtiopsis*, and *Neotorularia*) based on morphological similarity (Hedge, 1968; Jafri, 1973; Al-Shehbaz, 1988; Ball, 1993). Rather than showing a close relationship among these genera, our work indicates that the circumscription of some of these genera and *Arabidopsis* is needed to better represent phylogenetic relationships. Recently, for instance, *A. erysimoides* has been moved to *Erysimum* (Al-Shehbaz, 1994), *A. parvula* (Schrenk) O. E. Schulz has been transferred to *Thellungiella* (Al-Shehbaz & O'Kane, 1995), and both *A. gamosepala* Hedge and *A. tuemurnica* Kuan & An have been placed in *Neotorularia* (Al-Shehbaz & O'Kane, 1997).

The nomenclatural changes proposed here aim to align the taxonomy of *Arabidopsis* with the results of recent analyses of rDNA sequences (O'Kane et al., 1997) and on-going phylogenetic analyses. The changes given here were anticipated by both Hylander (1957) and Ball (1993). Hylander (1957: 602–603) stated that should *Cardaminopsis* and *Arabidopsis* be combined, *Cardaminopsis* "must be dropped into the latter genus [*Arabidopsis*], the limits of which would thereby be considerably widened—or, perhaps more correctly, drawn in quite another way than e.g. by Schulz." Ball (1993: 322) echoed this by stating, "It seems probable that *Cardaminopsis* should be combined with *Arabidopsis*, and some species of *Arabidopsis* may have to be removed from the enlarged genus." Furthermore, Jones (1964) suggested that *Arabis cebennensis* and *A. pedemontana* might better be placed in the genus *Cardaminopsis* (here *Arabidopsis*). These earlier morphological predictions are now strongly supported by two independent molecular studies: Price et al. (1994) using chloroplast DNA restriction site variation and *rbc*L gene sequences, and O'Kane et al. (1997 and unpublished) using nuclear rDNA sequences. Essentially, the nomenclatural changes proposed herein deal with the transfer of species from *Cardaminopsis* to *Arabidopsis*. Except for the nine species and five subspecies treated in this paper, all of the remaining 49 binomials variously assigned to *Arabidopsis* are excluded from the genus. Work is in progress to assign those to other genera.

Arabidopsis (DC.) Heynhold, in Holl & Heynhold, Fl. Sachsen 1: 538. 1842; nom. cons. TYPE: *Arabidopsis thaliana* (L.) Heynhold.

Cardaminopsis (C. A. Meyer) Hayek, Fl. Steiermark 1: 477. 1908. Syn. nov. Basionym: *Arabis* sect. *Carda-*

minopsis C. A. Meyer, in Ledebour, Fl. Altaic. 3: 19. 1831. Type not designated.

Hylandra Á. Löve, Svensk Bot. Tidskr. 55: 211. 1961. TYPE: *Hylandra suecica* (Fries) Á. Löve.

The genus *Arabidopsis* can be recognized by the presence of short petiolate but never auriculate or amplexicaul cauline leaves, an indumentum of simple trichomes mixed with few-forked but never stellate ones, usually well-defined basal rosettes, white to lavender or rarely purple but never yellow flowers, erect to slightly ascending non-saccate or rarely slightly saccate inner sepals, at least slightly torulose, glabrous, compressed or rarely subterete to terete fruits with a distinct midvein from base to apex, uniseriate, wingless or rarely winged seeds, and accumbent or rarely incumbent cotyledons. The fact that *A. suecica* is an amphidiploid derived from *A. thaliana* and *A. arenosa* (as *Cardaminopsis* in most floras) (Hylander, 1957; Měsíček, 1967; Suominen, 1994; Mummenhoff & Hurka, 1995; O'Kane et al., 1997) further substantiates merging *Cardaminopsis* with *Arabidopsis*.

KEY TO THE SPECIES AND SUBSPECIES OF *ARABIDOPSIS*

1a. Fruit terete; petals 2–3.5(–4) mm long; seeds usually plump; cotyledons incumbent . . . . . *A. thaliana*
1b. Fruit strongly flattened, rarely subterete (*A. suecica*); petals (4–)5–10 mm long; seeds usually flattened; cotyledons accumbent, rarely obliquely incumbent (*A. suecica*).
2a. Stoloniferous perennials; basal leaves orbicular or pinnate with (sub)orbicular terminal lobes [*A. halleri*].
3a. Basal leaves entire or pinnate with weakly developed lateral lobes; lower cauline leaves orbicular to ovate, entire or crenate; flowering stems few, sparsely branched above *A. halleri* subsp. *ovirensis*
3b. Basal leaves pinnately lobed; lower cauline leaves oblong and dentate; flowering stems numerous, branched at base and often also above.
4a. Basal leaves pinnatifid, with 1–7 lateral lobes; petals white to lilac; plants of Europe . . . . . *A. halleri* subsp. *halleri*
4b. Basal leaves lyrate; petals white; plants of Russian Far East, northeastern China, Korea, and Japan . . . . . *A. halleri* subsp. *gemmifera*
2b. Non-stoloniferous perennials with or without branched caudices, or plants annual; basal leaves lanceolate, spatulate, oblanceolate, obovate, or rarely suborbicular, without orbicular terminal lobes.
5a. Lower and middle cauline leaves distinctly petiolate, suborbicular to ovate, nearly as long as wide, dentate with few large teeth.
6a. Petals 7–10 mm long, violet or sometimes white; plants 40–80 cm tall, sparsely pubescent; basal leaves acute at apex, longer than wide . . . . . *A. cebennensis*
6b. Petals 6–7 mm long, white; plants 15–30 cm tall, plants usually glabrous; basal leaves obtuse at apex, ± as long as wide . . . . . *A. pedemontana*
5b. Lower and middle cauline leaves subsessile or attenuate to a narrow base, much longer than broad, entire to small dentate, or lyrate to pinnatifid.
7a. Cauline and basal leaves similar in shape and size (rarely cauline larger than basal) . . . . . *A. croatica*
7b. Cauline and basal leaves dissimilar in shape and size, basal leaves always larger.
8a. Stems glabrous or rarely subglabrous; fruits horizontally spreading to slightly reflexed; petals becoming deep lilac; alpine areas in the Carpathian Mountains (Czech Republic, Slovakia, Romania, Poland, and adjacent Ukraine) . . . . . *A. neglecta*
8b. Stems sparsely to densely hairy at least below; fruits erect-ascending to subdivaricate; petals white or rarely pale lilac; sea level to various altitudes in Eurasia and North America.
9a. Fruits weakly compressed to subterete; petals white, 4–5 mm long; cotyledons obliquely incumbent . . . . . *A. suecica*
9b. Fruits strongly compressed; petals white to lilac, (5–)6–8 mm long; cotyledons accumbent.
10a. Petals with two small lateral teeth on the claw; basal leaves pinnatisect to pinnatipartite [*A. arenosa*].
11a. Basal leaves with terminal lobe larger than the 1–6 pairs of lateral lobes; seeds very narrowly winged or wingless . . . . . *A. arenosa* subsp. *arenosa*
11b. Basal leaves with terminal lobe subequal to or scarcely larger than the 4–9 pairs of lateral lobes; seeds conspicuously winged . . . . . *A. arenosa* subsp. *borbasii*
10b. Petals without lateral teeth on the claw; basal leaves lyrate-pinnatifid, lyrate, dentate, or entire [*A. lyrata*].
12b. Basal leaves entire to toothed; older plants with an obvious, somewhat thickened, often branched caudex . . . . . *A. lyrata* subsp. *petraea*
12b. Basal leaves mostly lyrate to lyrate-pinnatifid; older plants with a fine, usually unbranched root crown.
13a. Basal leaves usually pubescent and sparsely hirsute on petiole

margins; petals 6–8 mm long; fruit to 1 mm wide; style 0.5–1 mm long . . . . . *A. lyrata* subsp. *lyrata*

13b. Basal leaves glabrous to sparsely pubescent, petioles usually glabrous; petals (4–)5–6 mm long; fruit ca. 1.5 mm wide; style often less than 0.5 mm long . . . . . *A. lyrata* subsp. *kamchatica*

Arabidopsis arenosa (L.) Lawalrée, Bull. Soc. Roy. Bot. Belg. 42: 242. 1969. Basionym: *Sisymbrium arenosum* L., Sp. Pl. 2: 658. 1753. TYPE: "In Germania, Helvetica" (holotype, LINN 836.22).

Subspecies *arenosa* is distributed in most of Europe (adventive in the north) and east to western Siberia. This is a highly variable taxon with a multitude of chromosomal races (Měsíček, 1970) that are sometimes segregated into weakly defined taxa, especially in the western Carpathians. The taxon approaches both *Arabidopsis suecica* and *A. neglecta* morphologically and is distinguished from these by the characters in the key above.

Arabidopsis arenosa (L.) Lawalrée subsp. **borbasii** (Zapałowicz) O'Kane & Al-Shehbaz, comb. nov. Basionym: *Arabis arenosa* (L.) Scopoli subsp. *borbasii* Zapałowicz, Rozpr. Wydz. Mat.-Przyr. Acad. Umiejetn., Dzial B, Nauki Biol. 52: 31. 1912. TYPE: Poland. Carpathians, Babia Góra monte, 1285–1725 m, *Zapałowicz s.n.* (lectotype, here designated, KRAM).

Subspecies *borbasii* is the only infraspecific taxon of *Arabidopsis arenosa* that can be consistently distinguished from subspecies *arenosa*. Like the latter, subspecies *borbasii* has variously been split into poorly defined races, and as recognized here, it is limited to central Europe.

Arabidopsis cebennensis (DC.) O'Kane & Al-Shehbaz, comb. nov. Basionym: *Arabis cebennensis* DC., Syst. Nat. 2: 234. 1821. TYPE: [France], "in locis asperis subumbrosis montium Cebennorum in horto Dei et Bramabiou" (holotype, G-DC).

This species is restricted to the mountains of southern France. Morphologically it is like *Arabidopsis pedemontana* except that it is larger in all respects and is sparsely pubescent rather than glabrous or subglabrous.

Arabidopsis croatica (Schott) O'Kane & Al-Shehbaz, comb. nov. Basionym: *Arabis croatica* Schott, in Schott, Nyman & Kotschy, Analect. Bot. 44. 1854. TYPE: Croatia, *F. Maly s.n.* (holotype, BP? not seen).

Endemic to Croatia. The species is morphologically and phylogenetically close to *Arabidopsis arenosa* and could conceivably be treated as a subspecies of that taxon.

Arabidopsis halleri (L.) O'Kane & Al-Shehbaz, comb. nov. Basionym: *Arabis halleri* L., Sp. Pl. ed. 2, 2: 929. 1763. TYPE: [Germany, Harzgebirge] as "Harcynia ad Clausthal, locis humedis" (holotype, LINN 842.11).

Subspecies *halleri* is distributed throughout Europe except in the western part, the far north, and most of Italy. It is a montane species that grows at elevations generally below timberline.

Arabidopsis halleri (L.) O'Kane & Al-Shehbaz subsp. **ovirensis** (Wulfen) O'Kane & Al-Shehbaz, comb. nov. Basionym: *Arabis ovirensis* Wulfen, in Jacquin, Collectanea 1: 196. 1786. TYPE: [Austria] Ovirensis supra Ebriacum in Valle Junonia percurrerem alpes, *Wulfen s.n.* (holotype, W).

Distributed in southern and eastern Europe, generally at high elevations above timberline, in the southeastern Alps, the Carpathians, and the northern Balkan Peninsula.

Arabidopsis halleri (L.) O'Kane & Al-Shehbaz subsp. **gemmifera** (Matsumra) O'Kane & Al-Shehbaz, comb. nov. Basionym: *Cardamine gemmifera* Matsumra, Bot. Mag. (Tokyo) 13: 49. 1899. TYPE: Japan. Prov. Shinano: monte Norikura, 1891, *K. Fuji s.n.* (holotype, TI).

A taxon of the Russian Far East, northeastern China, Korea, and Japan, typically occurring in shaded, moist situations from sea level onto low mountains.

Arabidopsis lyrata (L.) O'Kane & Al-Shehbaz, comb. nov. Basionym: *Arabis lyrata* L., Sp. Pl. 2: 665. 1753. TYPE: Canada, *D. Kalm s.n.* (holotype, LINN 842.8).

The species is circumboreal. Subspecies *lyrata* is entirely North American and ranges from Minnesota and Wisconsin south into Missouri, east into Georgia, north into Vermont, and west into Ontario. It is rare in Manitoba, Saskatchewan, Alberta, and

British Columbia (Mulligan, 1995). It is distinguished only with difficulty from the other subspecies of *Arabidopsis lyrata*, especially in areas where they come into contact. Mulligan (1995) treated the three subspecies of *A. lyrata* as distinct species, but as shown in the key above, the morphological differences between them do not support such a treatment.

Arabidopsis lyrata (L.) O'Kane & Al-Shehbaz subsp. **kamchatica** (Fischer ex DC.) O'Kane & Al-Shehbaz, comb. nov. Basionym: *Arabis lyrata* L. var. *kamchatica* Fischer ex DC., Syst. Nat. 2: 231. 1821. TYPE: [Russia], Kamchatka, *Fisher s.n.* (holotype, LE).

Arabis morrisonensis Hayata, J. Coll. Sci. Imp. Univ. Tokyo 30(1): 29. 1911. Syn. nov. TYPE: Taiwan, monte Morrison, 13,094 ft., Nov. 1905, *S. Nagasawa 680* (holotype, TI).

Arabis kawasakiana Makino, Bot. Mag. (Tokyo) 27: 24. 1913. Syn. nov. TYPE: Japan. Prov. Ise: Yokkaichi, *M. Kawasaki s.n.* (holotype, MAK).

Distributed in boreal regions of North America, far eastern Siberia, the Russian Far East, south to and including Korea and northern China, Japan, and south to Taiwan (collections in the last were described as *Arabis morrisonensis*). In the Russian Far East, subspecies *kamchatica* tends to grow closer to the sea than does subspecies *petraea*, which is a more continental taxon. Plants of subspecies *kamchatica* growing in sandy, ocean-side localities tend to have massive leaves and seem indistinguishable from those described as *Arabis kawasakiana* of Japan. In Japan, *Arabidopsis lyrata* subsp. *kamchatica* is found on more rocky, mountain slopes, and *Arabis kawasakiana* is found in sandy lowlands near the sea (Ohwi, 1965). Therefore, *Arabis kaswasakiana* is treated as a synonym of *Arabidopsis lyrata* subsp. *kamchatica*, being just a large-leaved and less hairy ocean-side form. Mulligan (1995) treated subspecies *kamchatica* as a species of *Arabis*, whereas Rollins (1993) treated it as a variety of *Arabis lyrata*.

Arabidopsis lyrata (L.) O'Kane & Al-Shehbaz subsp. **petraea** (L.) O'Kane & Al-Shehbaz, comb. nov. Basionym: *Cardamine petraea* L., Sp. Pl. 2: 654. 1753. TYPE: "In Angliae, Arvoniae, Mervinae, Sueciae, rupibus excelsis" (holotype, LINN 835.5).

Arabis media N. Busch, Bot. Mater. Gerb. Glav. Bot. Sada RSFSR 3(3-4): 11. 1922. Syn. nov. TYPE: [East Siberia]. "Zona arctica! et subarctica! ab ostio Lenae! usque ad Anadyr!, montes Sajanenses orientales!, montes cis-et transbaicalenses! atque Jacutenses!" (holotype, LE not seen).

Distributed in parts of central, northern, and eastern Europe, east across boreal Asia to the Far East and boreal North America (Alaska and Yukon). Beginning in central Siberia, the taxon is increasingly similar to subspecies *kamchatica*, and many collections can only doubtfully be assigned to one or the other taxon. North American plants of subspecies *petraea* have been placed in *Arabis media* by Mulligan (1995).

Arabidopsis neglecta (Schultes) O'Kane & Al-Shehbaz, comb. nov. Basionym: *Arabis neglecta* Schultes, Oestr. Fl. 2: 248. 1814. TYPE: Carpathians, *Schultes? s.n.* (holotype, M).

The species is endemic to high altitudes in the Carpathian Mountains (Czech Republic, Slovakia, Romania, Poland, and adjacent Ukraine).

Arabidopsis pedemontana (Boissier) O'Kane & Al-Shehbaz, comb. nov. Basionym: *Arabis pedemontana* Boissier, Diagn. Pl. Orient. 1: 69. 1843. TYPE: [Switzerland], "In regione alpina montium Pedemontii, legi Aug. supra limitem arborum in collo inter Crissolo et Luzerna sitio" (holotype, G).

The species is restricted to northwestern Italy and, presumably extinct, in Switzerland. Morphologically similar to *A. cebennensis* except smaller (15–30 cm instead of 40–80 cm) and glabrous or subglabrous instead of sparsely pubescent.

Arabidopsis suecica (Fries) Norrlin, Meddel. Soc. Fauna Fl. Fenn. 2: 12. 1878. Basionym: *Arabis suecica* Fries, Summa Veg. Scand. 1: 147. 1846. TYPE: Sweden. Prov. Södermanland: Strängnäs, *Fries s.n.* (lectotype, UPS; see Löve, 1961).

This species is shown to be an amphidiploid formed from *A. thaliana* and *A. arenosa* (O'Kane et al., 1997, and references therein) since the last glacial maximum. The species is distributed in Fennoscandinavia and the Baltic region and is probably adventive in a few locations in Germany. In addition to phylogenetic considerations, the fact that *A. suecica* is an ancient hybrid between *A. thaliana* and *Cardaminopsis arenosa* [*A. arenosa*] clearly supports the argument for combining *Cardaminopsis* with *Arabidopsis*.

Arabidopsis thaliana (L.) Heynhold, in Holl & Heynhold, Clav. Gen. Fl. Sachsen 1: 538.

1842. Basionym: *Arabis thaliana* L., Sp. Pl. 2: 665. 1753. TYPE: "Europae septentrionalioris sabulosis" (holotype, LINN 842.5).

Arabidopsis thaliana is the conserved type of *Arabidopsis* (Greuter et al., 1994). Native to Eurasia, adventive elsewhere in the world, distributed in open or disturbed habitats in temperate regions.

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Holomitrium hawkinsii (Musci: Dicranaceae), A New Species from Central America, and a Key to *Holomitrium* in Central America

Bruce Allen
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. *Holomitrium hawkinsii* differs from all other species in the genus by its dioicous condition with full-sized male and female plants. It is close to *H. pulchellum*, an entire-leaved species of *Holomitrium*, but is a larger plant with longer, more slender leaves that have upper margins obscurely and distantly dentate to spiculose, and lower leaf margins distantly serrulate. A key to the seven species of *Holomitrium* in Central America is given.

In Central America the genus *Holomitrium* (Dicranaceae) is usually found at relatively high elevations growing as an epiphyte on humus mats and the roots of other vascular epiphytes in tree canopies. It also occurs on upper tree trunks and occasionally on humus over boulders. It is acrocarpous and a member of the haplolepidous series of mosses. On account of its short capsule neck, papillose and irregularly divided (although sometimes entire) peristome teeth, narrow costa, phaneroporic stomata, well-developed alar cells, and differentiated perichaetial leaves the genus is placed in subfamily Dicranoideae of the Dicranaceae. Members of *Holomitrium* are generally robust, have strong, narrow, single costae, distinctly different basal and upper leaf cells, well-developed alar cells, long-sheathing perichaetial leaves, cucullate calyptrae, erect capsules, subulate-rostrate opercula, and variously divided (sometimes undivided) peristome teeth. There are recent treatments of *Holomitrium* for Mexico (Ireland, 1994) and the Caribbean (Hegewald, 1978). Allen (1990, 1994) treated six Central American species, one of which (*H. pulchellum* Mitten) he considered so polymorphic that it might represent two species. On the basis of recent field experience, an evaluation of many new collections, and a re-evaluation of the original collections of this taxon, it now appears that *H. pulchellum* (as treated by Allen, 1990, 1994) represents two distinct species, one of which is new to science.

Holomitrium hawkinsii B. H. Allen, sp. nov. TYPE: Honduras. Lempira: Moñtana de Celaque, summit Cerro Mojon, 13 km SW of Gracias, 2849 m, 14°32′N, 88°41′W, *Allen 12240* (holotype, MO; isotypes, NY, TEFH, US). Figure 1A–J.

A *H. pulchello* Mitten statura grandi, foliis angustis, sexu dioico, marginibus superis foliorum obscure et dissite dentatis vel spiculatis, marginibus basilibus foliorum dissite serrulatis differt.

Plants large, tufted, greenish yellow to brownish yellow, corticolous or humicolous. Stems erect to 6 cm high, branches few, irregular, simple. Leaves crowded, erect at base spreading above when wet, twisted to spirally contorted, crispate above when dry, variably undulate at margins, keeled. Leaves lanceolate from a narrowly ovate base, long, slenderly acuminate, 5–8 mm long, margins erect to narrowly recurved above, undulate, weakly and distantly serrulate at base, dentate to spiculose at middle, serrate at extreme apex, unistatose, costa strong, percurrent, upper and median leaf cells rounded, quadrate, short rectangular or oblate, 8–10 μm long, 6–14 μm wide, incrassate, cell walls straight, basal leaf cells linear, 40–100 μm long, 6–8 μm wide, incrassate and pitted, alar cells poorly developed, fugacious, upper and basal leaf cells ± sharply demarcated. Dioicous. Male plants full-sized, perigonia terminal, with growth continued by

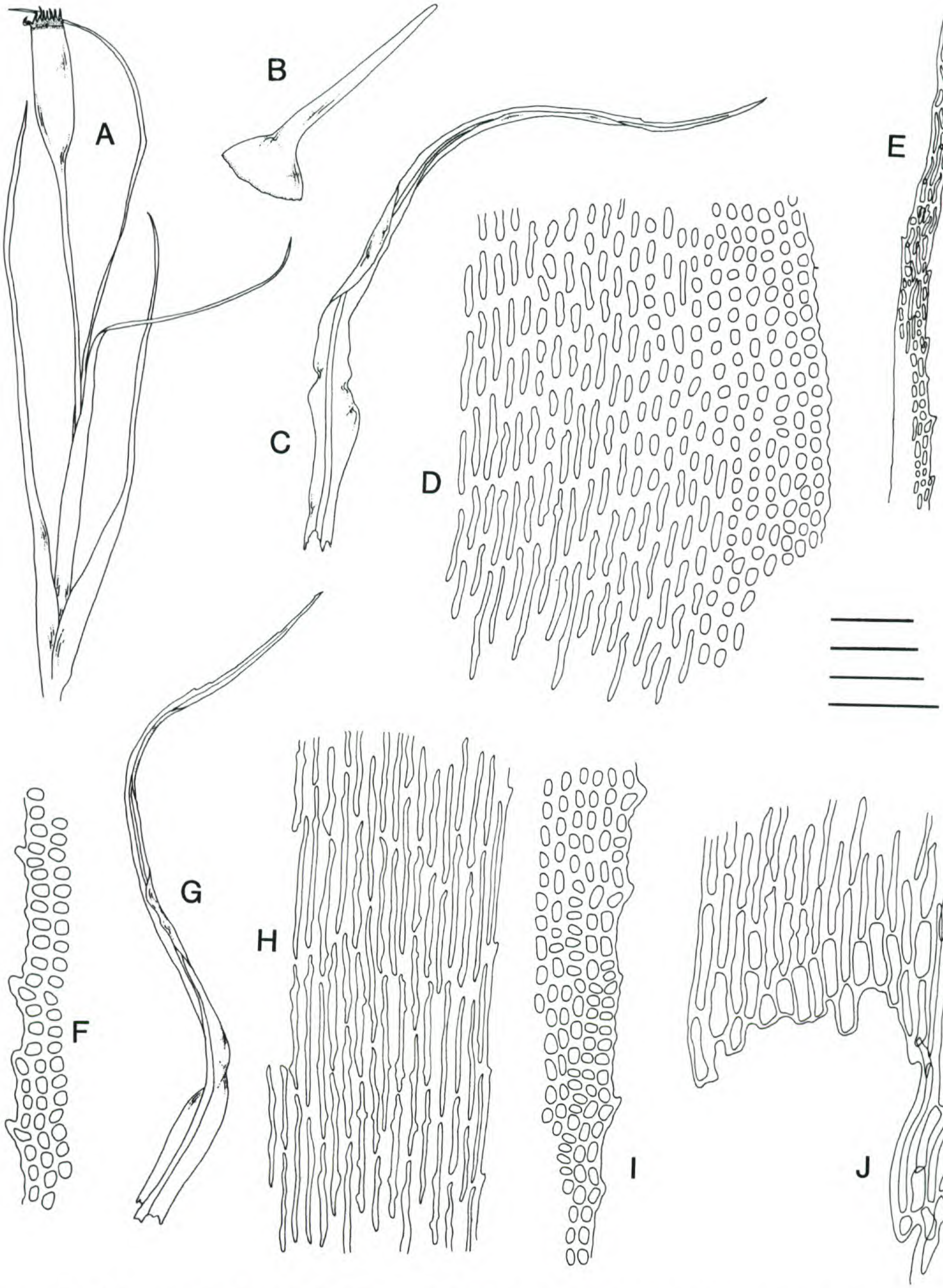

Figure 1. *Holomitrium hawkinsii* B. H. Allen. —A. Sporophyte and perichaetial leaves. —B. Operculum. —C, G. Leaves. —D. Leaf cells in region of transition between upper and basal cells. —E. Leaf apex. —F, I. Mid-leaf margins. —H. Basal leaf cells. —J. Basal cells in alar region showing gap left by fugacious alar cells. Scales in mm: top = 0.05 (D, F, H, I, J); top = 0.1 (E); subtop = 1.0 (A); subbottom = 0.5 (B); bottom = 0.5 (C, G). Drawn by the author.

subterminal branching, the stems appearing forked. Perichaetial leaves sheathing, often over-topping the capsule. Setae to 14 mm long, yellow. Opercula subulate-rostrate, 2–2.5 mm long. Capsules erect, cylindrical, 2–3 mm long, mostly yellow with 6–8 rows of red, oblong, thick-walled cells at mouth. Stomata phaneroporic, in capsule neck. Peristome haploledipous, teeth 16, dorsal (outer) surface bright red, ventral (inner) surface yellow, papillose throughout, entire, fenestrate, or distal ⅔ irregularly divided. Spores 12–16 μm, lightly roughened. Calyptra cucullate, smooth, 3 mm long.

Etymology. The specific epithet *hawkinsii* is given in honor of Thomas Edward Hawkins, friend and field companion in Honduras and Belize.

Distribution. Honduras (Cortés, Lempira, San Bárbara); Costa Rica (Heredia, Puntarenas); Panama (Chiriquí).

Habitat. On tree trunks (e.g., *Cupressus*, *Quercus*) and on humus and roots of epiphytic plants in tree crowns and upper branches; 1350–2849 m.

Holomitrium hawkinsii is a robust, dioicous species with long, slender leaves that are spirally contorted when dry. The leaf margins are sinuate and distantly obscurely dentate to spiculose in the middle to upper parts but distantly serrulate at base. The alar cells are poorly developed and fugacious with most of the cells remaining on the stem when the leaves are stripped off. The basal leaf cells are narrowly linear, incrassate and porose while the upper leaf cells are shortly rectangular, quadrate or oblate with incrassate but straight walls. Although the distinction between the upper and basal cells is sharp, as in *H. arboreum* Mitten, the quadrate upper leaf cells extend downward along the margins into the basal region farther than those near the costa. In overall aspect it resembles several of the long, slender-leafed *Macromitrium* species commonly found at higher elevations in Central America. But those species of *Macromitrium*, which is pleurocarpous and belongs in the diplolepidous series of mosses, generally have tuberculate basal leaf cells and somewhat smaller, less thickened upper leaf cells.

Perhaps the most interesting feature of *H. hawkinsii* is its regular dioicous sexual condition, i.e., with full-sized male and female plants. This represents the first report of full-sized males in *Holomitrium*, an otherwise pseudautoicous (i.e., with dwarf males) genus. The peristome of *H. hawkinsii* is also distinctive in the variable development of the peristome teeth. On a single capsule the teeth can be entire, fenestrate, or irregularly divided in the upper ⅔.

Within *Holomitrium* there are two major species groups: those with sharply serrate and those with entire upper leaf margins. The leaf margins of *H. hawkinsii*, which are sinuate and have small, weak, distantly spaced teeth, are intermediate to these two groups. From *H. pulchellum* it differs in its sexual condition, larger plant and setae size, more slender leaves that are more spirally contorted, its dentate to spiculose upper leaf margins, and serrulate basal leaf margins. In plant size and aspect it resembles *H. sinuosum* B. H. Allen, and that species sometimes has weak and distantly spaced dentate to spiculose upper leaf margins. However, that species has strongly porose and sinuose cells throughout the leaf with little or no differentiation between the upper and basal cells, a pseudautoicous sexual condition, and well-developed, persistent alar cells. All other species of *Holomitrium* in Central America differ from *H. hawkinsii* in having sharply serrate leaf margins and a pseudautoicous sexual condition.

Holomitrium aberrans Frahm has recently been described from the nearby Chocó region of Colombia (Frahm, 1994). This species is especially critical to an understanding of the *Holomitrium/Eucamptodontopsis/Schliephackea* complex, since it exhibits features of all three genera. It differs from *H. hawkinsii* in having sharply serrate leaf margins and long rectangular upper leaf cells.

Paratypes. HONDURAS. **Cortés:** Cusuco National Park, from Rio Cusuco to summit of Cerro Jilinco, ca. 22 km W of San Pedro Sula, 16 km S of Cuymel, 1600–2242 m, 15°31′N, 88°14′W, *Allen 14260* (MO, TEFH). **Lempira:** Montaña de Celaque, along ridge to summit of Cerro la Castilla, 2650 m, 14°33′N, 88°41′W, *Allen 11572* (MO, TEFH). **Santa Bárbara:** E slope of Mt. Santa Bárbara, trail to minor peak, ca. 7 km N of El Mochito, 2640 m, 14°55′N, 88°07′W, *Allen 11677* (MO, TEFH). COSTA RICA. **Heredia:** vicinity of Vara Blanca, 1880 m, *Croat 35551A* (MO). **Puntarenas:** along road between Santa Elena and Monteverde, ca 2.5 mi. from Santa Elena–Monteverde junction near E edge of Monteverde reserve, 1350 m, *Croat 47132* (MO). PANAMA. **Chiriquí:** Cerro Colorado, 4.3 mi. above Chami Camp, 1500 m, 8°35′N, 81°45′W, *Allen 5418* (MO, NY, PMA, US).

KEY TO THE SPECIES OF *HOLOMITRIUM* IN CENTRAL AMERICA

1a. Leaf margins entire or sinuate below, serrate at extreme apex 2
1b. Leaf margins sharply serrate or distantly and weakly dentate to spiculose from below midleaf to the apex 3
  2a. Upper leaf cells quadrate with straight or wavy walls; basal leaf cells strongly differentiated from upper cells; setae 5–10 mm long . . . . . *H. pulchellum* Mitten
  2b. Upper leaf cells elongate with sinuose walls;

basal leaf cells grading into upper cells; setae 10–15 mm long . . *H. sinuosum* B. H. Allen

3a. Leaf margins distantly and weakly dentate to spiculose from below midleaf to the apex; plants dioicous with full-sized males . . . . . *H. hawkinsii* B. H. Allen

3b. Leaf margins sharply serrate from below midleaf to the apex; plants pseudautoicous with dwarf males 4

4a. Quadrate upper leaf cells extending downward along the margins into the basal region; leaf cells at basal margins quadrate to rectangular, wider than the inner basal cells, and weakly to not porose . . . . *H. arboreum* Mitten

4b. All quadrate upper leaf cells ending at same level in the lower leaf; leaf cells at basal margins elongate to linear, narrower than the inner basal cells and porose 5

5a. Upper leaf cells elongate, the outer cell walls sinuose . . . . . *H. terebellatum* C. Müller

5b. Upper leaf cells quadrate with straight cell walls . . 6

6a. Upper leaves over 10 mm long, oblong at base, gradually narrowed to the apex, unistratose throughout; deciduous branchlets absent . . . . . *H. longifolium* Hampe

6b. Upper leaves less than 7 mm long, oblong-ovate at base, abruptly narrowed from base, bistratose at margins and medially in rows; occasionally with clusters of deciduous branchlets at apex . . . . . *H. williamsii* E. B. Bartram

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Cytological and Nomenclatural Notes on the Mesoamerican Species of *Aciotis* (Melastomataceae)

Frank Almeda

Department of Botany, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118-4599, U.S.A.

ABSTRACT. A review of the Mesoamerican species of *Aciotis* is presented to facilitate the transfer of *Spennera alata*, an earlier name for the largely Central American species heretofore known as *A. levyana*. Original chromosome counts of $n = 30$ are reported for two species, *A. alata* and *A. rostellata*, together with brief descriptions, distributional notes, and a regional key to the three Mesoamerican species. Based on a preliminary evaluation of reported chromosome counts, $x = 10$ appears to be the probable base chromosome number of *Aciotis*.

Aciotis is one of about 30 capsular-fruited genera of the tribe Melastomeae (incl. Tibouchineae) restricted to the Neotropics. This natural genus of herbs and subshrubs is readily distinguished by its small 4-merous flowers borne in terminal panicles, terete hypanthia, eight unappendaged stamens, bilocular ovary, and reniform-cochleate seeds with a foveolate or costate-foveolate testa.

Because macromorphological differences among the approximately 30 recognized species (Mathies, 1981) are not always as sharp or as consistent as those encountered in other neotropical genera of the tribe, *Aciotis* has the reputation of being a taxonomically difficult genus (Wurdack, 1973). Recently, Mathies (1981) contributed to an evaluation of species limits, but the genus is still in need of a thorough field-oriented revisionary study.

Despite taxonomic difficulties, identity of the three described species of *Aciotis* from the Mesoamerican region has not been a major source of confusion. However, examination of type specimens and verification of the identity of taxonomic synonyms pertinent to a treatment of the genus for *Flora Mesoamericana* has brought to light the need for a new combination that has heretofore been overlooked. *Spennera alata*, therefore, is transferred here to *Aciotis* and a synopsis of the three Mesoamerican species is provided together with a key, original meiotic chromosome counts for two of the taxa, and a discussion of the probable base chromosome number of the genus.

CHROMOSOME NUMBERS OF *ACIOTIS*

Gametic chromosome numbers are reported here for two populations each of *A. alata* and *A. rostellata*. Meiosis was regular with $n = 30$ in all cells examined from each of these populations. Bud material for these counts was collected from natural populations in the field, fixed in modified Carnoy's solution (4 chloroform, 3 ethanol, 1 glacial acetic acid, v/v/v) for 24 hours, transferred to 70% ethanol, and stored under refrigeration. All counts were made using a Zeiss light microscope with phase contrast and a 100× oil immersion objective. Drawings of meiotic figures were made with camera lucida at a magnification of 2100×. Voucher collections for each of the counts reported here are as follows:

Aciotis alata (Beurling) Almeda. $n = 30$ (Figs. 1, 2).

Costa Rica. Limón: Forest Reserve at Agricultural College of the Humid Tropical Region ca. 11 km NE of the Guapiles/Limón Hwy. at a point 20 km SE of Guapiles, 250 m, 11 Feb. 1992, *Almeda et al. 6953* (CAS, CR).

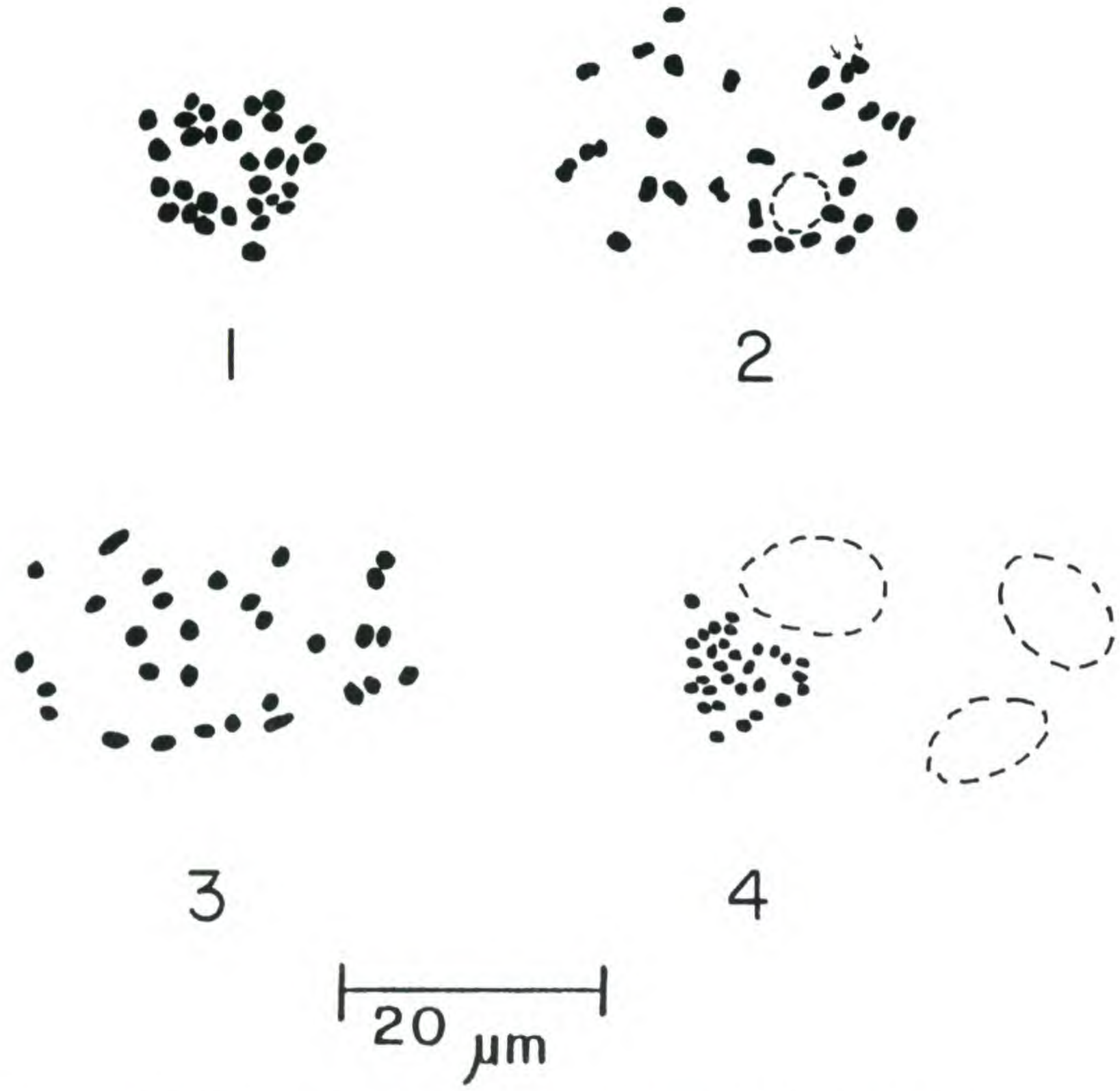
Panama. Panamá: Cerro Jefe, along summit road and along trail into the Chagres valley, 900 m, 19 Feb. 1988, *Almeda et al. 5836* (CAS, PMA).

Aciotis rostellata (Naudin) Triana. $n = 30$ (Figs. 3, 4).

Panama. Coclé: beyond La Mesa on road to the base of Cerro Gaital, 900–1100 m, 23 Feb. 1988, *Almeda et al. 5884A* (CAS, PMA).

Panama. Coclé: slopes above El Copé along abandoned trail to Continental Divide, 700–850 m, 24 Jan. 1989, *Almeda et al. 6379* (CAS, PMA).

The chromosome count of $n = 30$ reported here for two Panamanian populations of *A. rostellata* confirms an identical report for a Costa Rican population of this species by Solt and Wurdack (1980). This same gametic number, which is also reported here for Costa Rican and Panamanian populations of *A. alata*, is a new number for this species. Solt and Wurdack (1980) reported $2n = 24$ for this species (as *A. levyana*) from Costa Rican seedling ma-



Figures 1–4. Camera lucida drawings of meiotic chromosome figures of *Aciotis*. —1. *A. alata*, $n = 30$, metaphase I (*Almeda et al. 6953*). —2. *A. alata*, $n = 30$, diakinesis (*Almeda et al. 5836*). —3. *A. rostellata*, $n = 30$, late diakinesis (*Almeda et al. 5884A*). —4. *A. rostellata*, $n = 30$, telophase II (*Almeda et al. 6379*).

terial. Although multiple cytotypes within a species are not unknown in the Melastomataceae, I am inclined to regard unusual counts such as this one with skepticism, pending verification.

Meiotic chromosome counts have been reported for four species of *Aciotis* (Solt & Wurdack, 1980). One other species, *A.* aff. *aristellata* Markgraf, has $n = 30$. *Aciotis polystachya* (Bonpland) Triana has $n = 10$, *A. purpurascens* (Aublet) Triana has $n =$ ca. 40, and *A. laxa* (Richard) Cogniaux reportedly has $n = 26$. Although sampling is still limited, $x = 10$ is the only candidate for a generic base number indicated by the spread of reported numbers. A base of $x = 10$ is consistent with the commonly reported numbers of $x = 9$, 10, 11, and 12 for many genera in the tribe Melastomeae (Almeda, 1997; Almeda & Chuang, 1992; Solt & Wurdack, 1980). Assuming $x = 10$ is the probable base number for *Aciotis*, the two Mesoamerican species with $n = 30$ are hexaploid and the third, with $n =$ ca. 40, is octoploid. Despite the comparatively small morphological differences among species of *Aciotis*, this genus exhibits some surprising diversity in chromosome numbers. In this respect it is reminiscent of the pattern of species relationships demonstrated for the species of *Pilocosta* with multiple cytotypes. This pattern involves chromosomal evolution that promotes reproductive isolation but precedes significant amounts of morphological differentiation (Almeda, 1993).

In view of the polyploidy already evident for the small sampling of *Aciotis* to date, additional chromosome data will be essential in any attempt to better understand variation and interspecific relationships.

Key to the Mesoamerican Species of *Aciotis*

1a. Leaf blades glabrous or sparsely and deciduously strigillose on both surfaces . . . . 2. *A. purpurascens*

1b. Leaf blades persistently pubescent on both surfaces.

2a. Distal internodes conspicuously winged, the wings 0.5–2.5 mm wide with scattered prevailingly eglandular, stiff hairs mostly (0.5–)1–3 mm long; petioles winged . . . . . 1. *A. alata*

2b. Distal internodes strongly angled but not conspicuously winged (wings, if present, less than 0.5 mm wide), densely glandular-pilose with hairs prevailingly 0.25–0.5 mm long; petioles essentially wingless . . 3. *A. rostellata*

SYNOPSIS OF *ACIOTIS* IN MESOAMERICA

1. Aciotis alata (Beurling) Almeda, comb. nov. Basionym: *Spennera alata* Beurling, Kongl. Vetensk. Acad. Handl. 40: 125. 1854. TYPE: Panama. Panamá: Portobello, in montibus, Apr. 1826, *Billberg s.n.* (holotype, S, photograph, CAS).

Aciotis levyana Cogniaux, Mart. Fl. Bras. 14(3): 460. 1885. Syn. nov. TYPE: Nicaragua. Chontales, *Levy 497* (holotype, P; isotypes, BR, F, G, GH, NY, US).

Erect perennial herb or subshrub to 1 m tall; internodes quadrate with wings 1–3 mm wide bearing spreading simple hairs (0.5–)1–3 mm long. Leaves 5-nerved, oblong-ovate to ovate, 4–10(–17) × 1.5–4.5(–8) cm, upper and lower surfaces sparsely to moderately setose with smooth eglandular hairs mostly 1–2 mm long, apex acute to acuminate, base obtuse to rounded; margin ciliate-serrulate; petiole 0.5–2.5 cm long, winged and moderately to copiously beset with spreading simple hairs 1–2 mm long. Mature hypanthium 2–2.5 mm long, globose, sparsely puberulent with gland-tipped hairs mostly less than 0.5 mm long; calyx lobes 0.5 mm long and 1 mm wide basally between sinuses; petals white, 2–5 mm long, glabrous except for the apical glandular hair; stamens alternately somewhat unequal in size; anther thecae deep pink or white with tints of pink, oblong with a truncate to somewhat ventrally inclined apical pore; connective shallowly bilobed ventrally at the filament insertion; large anthers 0.75–1 × 0.25–0.5 mm, connective prolonged 0.25 mm; small anthers 0.5–0.75 × 0.5 mm long, connective prolonged 0.25 mm. Style 3.5–4.5 mm long.

Distribution, habitat, and phenology. Belize, Guatemala, Honduras, Nicaragua, Costa Rica, Panama, Colombia, Venezuela, Surinam (fide Mathies, 1981), Ecuador, Peru, and Brazil in wet disturbed sites, river banks, and forest margins at 0–800 (–1300) m. Collected in flower from January through September, in fruit from December through September. Mathies (1981) cited a single specimen of this species (*Maguire 24610*, NY) from Tafelberg Arrowhead Basin in Surinam, but Wurdack (1993) did not attribute it to any of the Guianas.

The type of *Aciotis levyana* and all subsequent collections correctly identified with this epithet are an exact match for the type of *Spennera alata*. Both have winged internodes and petioles, and leaf blades that are persistently pubescent on both surfaces with spreading eglandular hairs mostly 1–3 mm long. These diagnostic vegetative characters coupled with the central Panamanian collection locality for *S. alata* leave no doubt that it and *A. levyana* are conspecific.

In Triana's (1871) disposition of species originally described in *Spennera*, he relegated *S. alata* to the synonymy of *A. purpurascens* without comment. Cogniaux's (1885, 1891) placement of *S. alata* in the synonymy of *A. purpurascens* appears to have been in deference to Triana's taxonomic opinion. In both publications, Cogniaux listed *S. alata* in synonymy with the notation "ex Triana" in parentheses. Thus, one can only surmise that Cogniaux never critically examined the type of *S. alata* because he described the same taxonomic entity as a new species, *A. levyana*, in *Flora Brasiliensis* (Cogniaux, 1885). In view of Cogniaux's comprehensive knowledge of the Melastomataceae for his time, it is not surprising that his taxonomic judgment has gone unchallenged. Consequently, all subsequent regional treatments of the family have adopted his name for this widespread species (Gleason, 1940, 1958; Standley & Williams, 1963; Wurdack, 1973, 1980). Mathies (1981), the only monographer of *Aciotis* in this century, also used *A. levyana* for this taxon. Unfortunately, he made no mention of *S. alata* in the synonymy of *A. purpurascens* nor did he include it in the synonymy of any other described species.

Mathies (1981) also attributed *A. rubricaulis* (DC.) Triana to Panama based on *Dwyer & Correa 8003* (UC). Wurdack (1993) excluded Panama from the range of this species in his account of *Aciotis* for the Guianas. Examination of this cited collection shows that it has all the characters of what I consider typical *A. alata*. These two taxa are evidently closely related and in need of critical comparison. As presently understood, *Aciotis rubricaulis* purportedly differs in having 5(–7)-nerved leaves with hairs prevailingly 1–1.5 mm long, few-flowered panicles, and distinctly dimorphic stamens.

2. Aciotis purpurascens (Aublet) Triana, Trans. Linn. Soc. London 28: 52. 1871. Basionym: *Melastoma purpurascens* Aublet, Hist. Pl. Guiane 1: 402. t. 54. 1775. *Miconia purpurascens* (Aublet) A. P. DC., Prodr. 3: 179. 1828. TYPE: French Guiana, "territorio Caux," *Aublet s.n.* (holotype, BM).

Aciotis purpurascens (Aublet) Triana var. *alata* Cogniaux, Mart. Fl. Bras. 14(3): 474. 1885. TYPE: Panama. Chagres, Isthmus of Panama, *Fendler 149* (lectotype, here designated, GH; isolectotypes, F, K, MO, US, W). [In naming this variety, Cogniaux cited two syntypes in the protologue, *Fendler 149* and *Billberg s.n.* The latter, which is the type of *A. alata*, was evidently never seen by Cogniaux. Consequently, his

diagnosis of this variety clearly describes the taxon here recognized as *A. purpurascens*. According to P. Bamps (in litt., 7 January 1997) no specimen of *Fendler 149* is represented among the holdings of *Aciotis* at BR. For expanded synonymy of *A. purpurascens*, see Mathies (1981).]

Suffrutescent herb or subshrub 0.5–1 m tall often with purple-tinted uppermost internodes and lower leaf surfaces; the internodal wings mostly less than 1.5 mm wide, glabrous or inconspicuously puberulous with hairs 0.25–0.5 mm long. Leaves 5–7-nerved, narrowly ovate to oblong-ovate, (6–)8–15 × 2.5–5.5 cm, glabrous or sparsely and deciduously strigillose on both surfaces with hairs 0.5 mm long or less, apex acute to subacuminate, base obtuse to rounded or somewhat cordulate, margin obscurely ciliolate-serrulate; petiole 1–1.5(–2.2) cm long, winged and glabrous or with inconspicuous hairs like those of internodal wings. Hypanthium 2–2.5 mm long, globose, glabrous or sparingly glandular-setulose; calyx lobes 0.3–0.5 mm long; petals white or flushed with pink, 4–5 mm long, glabrous except for an apical glandular hair; stamens alternately somewhat unequal in size; anther thecae linear-oblong with a truncate pore and an obscurely bilobed ventro-basal appendage; large anthers 1.2–1.5 × 0.3 mm, connective prolonged 0.7–1 mm; small anthers ca. 1 mm long, connective prolonged 0.7–1 mm. Style to 4 mm long.

Distribution, habitat, and phenology. Costa Rica, Panama, Colombia, Venezuela, all the Guianas, Ecuador, Peru, Brazil, Grenada, and Trinidad in moist disturbed sites, roadsides, trail margins, and river banks in rainforest at 0–1200(–1400) m. Collected in flower and fruit from February through November. Mathies (1981: 111) attributed this species to Nicaragua and Bolivia, but he cited no specimens from these countries and a lack of dots on his distribution maps also indicates that he saw no authentic material from these areas.

3. Aciotis rostellata (Naudin) Triana, Trans. Linn. Soc. London 28: 51. 1871. Basionym: *Spennera rostellata* Naudin, Ann. Sci. Nat. Bot. Ser. 3, 14: 143. 1850. TYPE: Mexico. Tabasco: Teapa, *Linden 637* (holotype, P; isotypes, BR (3 sheets), G, K, NY).

Suffrutescent herb 4–6 dm tall; internodes quadrate and strongly angled but not conspicuously winged or wings (if present) less than 0.5 mm wide, densely glandular-pilose with hairs prevailingly 0.25–0.5 mm long. Leaves 5–7-nerved, broadly elliptic to elliptic-ovate or ovate, (3–)5–10(–15) × 2–5 cm, upper and lower surfaces sparsely to copiously appressed or spreading glandular-puberulent, apex acuminate, base obtuse to rounded; margin ciliolate-serrulate; petiole 0.7–3.1 cm long, carinate or with narrow wings mostly less than 0.25 mm wide, moderately to copiously beset with glandular spreading hairs mostly 0.25–0.5 mm long. Mature hypanthium 2.5–3.5 mm long, globose, glandular-puberulent with hairs mostly less than 0.25 mm long; calyx lobes 0.5 mm long and 0.5–1.5 mm wide with a sparse abaxial glandular puberulence restricted to a median vertical line; stamens alternately unequal in size; anther thecae deep pink, linear oblong or narrowly elliptic with a truncate apical pore; connective exappendiculate; large anthers 1 × 1 mm, connective prolonged 0.25 mm; small anthers 0.5–0.75 × 0.25 mm, connective prolonged 0.25 mm. Style 3.5–4 mm long.

Distribution, habitat, and phenology. Southern Mexico (Chiapas, Tabasco, and Veracruz), Belize, Guatemala, Honduras, Nicaragua, Costa Rica, Panama, and Colombia in disturbed sites, savannas, river banks, and forest margins at 0–750(–1300) m. Collected in flower from February through November, in fruit from February through December.

This species exhibits some variation in the development of internodal and petiolar wings and in the length and density of glandular pubescence on petioles and branches. Some populations (*Orcutt 6514*, DS) have carinate internodes and petioles with glandular hairs mostly 0.25 mm long, whereas others (*Hammel 11963*, CAS) have winged internodes and petioles with glandular hairs that are 0.25–0.5 mm long. Mathies (1981) proposed as part of this complex two additional, unpublished, new taxa that he named "almedae" and "liesneri" from Costa Rica and Panama, respectively. The former has internodal and petiolar wings that are 0.25 mm wide, internodal hairs 0.5 mm long, and petiolar hairs 0.25–0.5 mm long. The latter has internodal wings 0.5–0.75 mm wide, petiolar wings 0.5 mm long, internodal hairs 0.25–0.5 mm long, and petiolar hairs 0.25–1.5 mm long. The significance of these modal differences is difficult to assess. Chromosome information is needed to determine whether they can be correlated with different ploidy levels.

Aciotis indecora (Bonpland) Triana, a widespread South American species, was also attributed to Belize and Guatemala by Mathies (1981). Examination of representative Central American material cited by Mathies (*Gentle 7907*, CAS) leaves no doubt that morphologically it is well within the range of *A. rostellata* as interpreted here.

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sistance in locating type specimens; William D'Arcy and James Solomon for providing type photos; the staffs of the Museo Nacional de Costa Rica, Instituto de Biodiversidad, Costa Rica, Universidad de Panama, and the Smithsonian Tropical Research Institute for logistical support; Gordon McPherson, Thomas F. Daniel, Pablo Sanchez, and Greg de Nevers for assistance in the field; Fei-Mei Chuang and the late Tsan Iang Chuang for help with the cytological work; and the curators and staffs of herbaria cited for loans of special material.

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Generic Limits and Taxonomy of *Hornungia*, *Pritzelago*, and *Hymenolobus* (Brassicaceae)

Oliver Appel
Institut für Allgemeine Botanik, Ohnhorststraße 18, 22609 Hamburg, Germany

Ihsan A. Al-Shehbaz
Missouri Botanical Garden, P. O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. The genera *Pritzelago* (= *Hutchinsia*) and *Hymenolobus* are reduced to synonymy of *Hornungia*. New combinations for *Hornungia alpina* and its subspecies are proposed. A key to the three species of *Hornungia* is provided.

Generic limits in the Brassicaceae are often arbitrary, usually based only on a few characters, and generally follow tradition rather than being well defined (see e.g., Rollins, 1959; Rollins & Shaw, 1973). However, this is not the case in the closely related *Hornungia* Reichenbach (monotypic), *Pritzelago* Kuntze (monotypic according to Laínz, 1984), and *Hymenolobus* Nuttall (monotypic). Acceptance of the three genera varied considerably among experts of the Brassicaceae and, as shown in Table 1, the genera were frequently united in various combinations.

The taxonomic status of the three genera became even more confusing because Meyer (1982) showed that the well-established name *Hutchinsia* R. Brown (1812) is illegitimate and should be replaced by the later and obscure *Pritzelago* (1891). *Hutchinsia* had to be abandoned because when published it included *Iberis rotundifolia* L., the holotype of the earlier and legitimate generic name *Noccaea* Moench (1802). For a detailed taxonomic history and complete list of synonymy, see Meyer (1982). A critical evaluation of the genera *Hornungia*, *Hymenolobus*, and *Pritzelago* is presented in Table 2.

All three species in Table 2 are indistinguishable in many features. They have ebracteate corymbose racemes that elongate in fruit, ascending non-saccate sepals, white petals, linear unappendaged filaments, lateral nectaries one on each side of the stamens, no median nectaries, obsolete styles, small entire stigmas, angustiseptate, glabrous, dehiscent, sessile, wingless fruits, keeled valves, complete septa, wingless seeds, and the same chromosome numbers. Additionally, both *Pritzelago* and *Hornungia* also have markedly unequal sized funicles at the ovary apex (Briquet, 1923: fig. 2). The similarities are remarkable. *Hornungia petraea* and *Hymenolobus procumbens* differ only in the number of ovules (and seeds) per locule and in the cotyledonary position (Table 2). However, markedly deviating ovule and seed numbers frequently occur within well-delimited and even small genera of the Brassicaceae. Evidently, ovule number is not a reliable character at the generic level, and examples of such variation are readily observed in *Ornithocarpa* Rose (2 spp.; Rollins, 1969) and *Stevenia* Adams & Fischer (4 spp.; Kamelin, 1995). Although some types of cotyledonary position (e.g., conduplicate or diplecolobal) are highly significant taxonomically and apparently evolved only once within the family, accumbent and incumbent cotyledons are linked by a series of intermediate forms (usually called oblique), and they obviously evolved independently numerous times. The cotyledonary position within genera or sometimes a given species may shift between accumbent and incumbent (Vaughan & Whitehouse, 1971). Therefore, the cotyledonary types in *Hornungia* and *Hymenolobus* are not reliable characters at the generic level, and intermediate forms are found in *Hornungia*. Evidently, these two species belong to one genus.

Pritzelago alpina differs from *Hornungia* and *Hymenolobus* in the perennial vs. annual habit, absence vs. presence of stem leaves, petal length, and the lack of seed mucilage (Table 2). The first two characters are adaptations to alpine rather than lowland habitats. Reduced petals occur in many genera of the family, and in at least 28 (e.g., *Thlaspi* L., *Isatis* L., *Draba* L.) both well-developed and reduced petals may be found (authors' compilation). Presence vs. absence of seed mucilage may also be found among species of a single genus (Vaughan & Whitehouse, 1971). Therefore, there is no single character of systematic value that would reliably serve to delimit *Hornungia*, *Hymenolobus*, and *Pritzelago*.

The results of this study strongly suggest that *Pritzelago*, *Hornungia*, and *Hymenolobus* cannot be

Table 1. Recognition of *Hornungia*, *Pritzelago*, and *Hymenolobus* by various authors.

	Hornungia petraea (L.) Reichenbach	*Pritzelago alpina* (L.) Kuntze	*Hymenolobus procumbens* (L.) Nuttall
Busch (1939), Hedge (1965)	---------- *Hutchinsia* ----------		*Hymenolobus*
Hegi (1986)	---------- *Hutchinsia* ----------		*Capsella*
Rollins (1993)	(not treated)	---------- *Hutchinsia* ----------	
Ball et al. (1993), Schulz (1936)	*Hornungia*	*Hutchinsia*	*Hymenolobus*

maintained as independent genera and that *Pritzelago alpina* and *Hymenolobus procumbens* are best treated as species of *Hornungia*, the oldest validly published name for this alliance.

Hornungia Reichenbach, Deutschl. Fl. 1: 33. 1837. TYPE: *Hornungia petraea* Reichenbach.

Hutchinsia R. Brown, in W. T. Aiton, Hortus Kew. ed. 2. 4: 82. 1812, nom. illeg.

Hutchinsiella O. E. Schulz, Bot. Jahrb. Syst. 66: 92. 1933. TYPE: *Hutchinsiella perpusilla* (Hemsley) O. E. Schulz.

Hymenolobus Nuttall, in Torrey & A. Gray, Fl. N. Amer. 1: 117. 1838. TYPE: Not designated.

Microcardamum O. E. Schulz, Notizbl. Bot. Gart. Berlin-Dahlem 10: 467. 1928. TYPE: *Microcardamum tenue* (Barnéoud) O. E. Schulz.

Pritzelago Kuntze, Revis. Gen. Pl. 1: 35. 1891. Syn. nov. TYPE: *Pritzelago alpina* (L.) Kuntze.

The three species of *Hornungia* are separated as follows:

1a. Plants perennial; leaves all basal; petals exceeding sepals; seeds not mucilaginous . . . . . *H. alpina* (L.) O. Appel

1b. Plants annual; leaves basal and cauline; petals about equaling sepals; seeds mucilaginous.

2a. Ovules 2 per locule; cotyledons accumbent or oblique . . . . . *H. petraea* (L.) Reichenbach

2b. Ovules (3–)5–10 per locule; cotyledons incumbent . . . . . *H. procumbens* (L.) Hayek

Hornungia alpina (L.) O. Appel, comb. nov. Basionym: *Lepidium alpinum* L., Cent. Pl. 2: 23. 1756. TYPE: "Habitat in alpibus Sneeberg, Tyrolensibus, Saltzburgensibus, Helveticis, Bladi. *Seguier s.n.*," 824 no. 5 (holotype, LINN).

One sheet at LINN, collected by Seguier, gave no locality data.

The following subspecies are well defined and have been recently recognized in the treatments of Ball et al. (1993) and Greuter et al. (1986). Therefore, their transfer to *Hornungia* is a simple, mechanical transfer that needs no further justification.

Hornungia alpina subsp. **auerswaldii** (Willkomm) O. Appel, comb. nov. Basionym: *Hutchinsia auerswaldii* Willkomm, Flora 34: 590. 1851. TYPE: Spain. In parte septentrionali occidentali montis calcarei Pena Gorveya in Vizcaya, ad alt. circ. 3–4000 m, 26 May 1850, *Pl. exs. coll. ven. no. 148* (holotype, COI).

Hornungia alpina subsp. **austroalpina** (Trpin) O. Appel, comb. nov. Basionym: *Hutchinsia alpina* subsp. *austroalpina* Trpin, Biol. Vestn. 22: 63. 1974 [1975]. TYPE: Yugoslavia. Slovenia, Primorsko, Julijske Alpe, Kanin, in glareosis, solo calcareo, ca. 2260 m, 5 Aug. 1955, *E. Mayer* (holotype, LJU, No. 59625).

Table 2. Comparison of *Hornungia*, *Pritzelago*, and *Hymenolobus*.

	Hornungia petraea	*Pritzelago alpina*	*Hymenolobus procumbens*
habit	annual	perennial	annual
pubescence	mostly pubescent	mostly pubescent	glabrous or pubescent
trichomes	simple and branched	branched and/or simple	simple and branched
leaves	basal and cauline	all basal	basal and cauline
basal leaves	pinnatisect	pinnatisect	entire to pinnatisect
petal length	not exceeding sepals	exceeding sepals	not exceeding sepals
stamen number	6	6	6 or 4
ovules per locule	2	2	(3–)5–10
fruit shape	elliptic to ovate	elliptic to lanceolate	elliptic to ovate
seed mucilage	present	absent	present
cotyledons	accumbent or oblique	incumbent	incumbent
n =	6	6	6 or 12

Hornungia alpina subsp. **brevicaulis** (Sprengel) O. Appel, comb. nov. Basionym: *Hutchinsia brevicaulis* Sprengel, Syst. Veg. 2: 863. 1825. TYPE: Summae alpes Carnith. (holotype, ?).

Hornungia alpina subsp. **font-queri** (Sauvage) O. Appel, comb. nov. Basionym: *Hutchinsia font-queri* Sauvage, Collect. Bot. (Barcelona) 7: 1096. 1968. TYPE: Morocco. Le versant nord du jbel Tissouka, 2050 m, 10 July 1961, *C. Sauvage 16975* (holotype, MPU).

Hornungia alpina subsp. **polatschekii** (Laínz) O. Appel, comb. nov. Basionym: *Hutchinsia alpina* subsp. *polatschekii* Laínz, Anales Jard. Bot. Madrid 41: 204. 1984. TYPE: Spain. Lagrán (Alva), Cruz del Castillo, rocas cara N, 1400 m, 19 July 1983, *J. Alejandre & G. Morante 5104/83* (holotype, AEPNA).

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Solanum maternum (Solanaceae), a New Bolivian Relative of the Tree Tomato

Lynn Bohs and Ann Nelson*
Department of Biology, University of Utah, Salt Lake City, Utah 84112, U.S.A.
*Present address: Department of Botany, Duke University,
Durham, North Carolina 27708-0338, U.S.A.

ABSTRACT. A new species endemic to Bolivia, *Solanum maternum*, is described. *Solanum maternum* belongs to a group of taxa formerly recognized as the genus *Cyphomandra*. *Solanum maternum* is morphologically very similar to the tree tomato, *Solanum betaceum*, and may be its closest wild relative.

The former genus *Cyphomandra* Sendtner encompasses a group of about 30 species of shrubs and small trees with usually large, pendent fruits. The group is characterized by the presence of an enlarged connective region on the abaxial anther surface; this structure may play a role in pollination by secreting volatile compounds that attract male euglossine bees (Gracie, 1993; Sazima et al., 1993; Soares et al., 1989). Other characteristics of the *Cyphomandra* group that occur in most, but not all, species include Prévost's architectural model, very large chromosomes, and gametophytic self-incompatibility (Bohs, 1994).

Recent molecular evidence indicates that the *Cyphomandra* group is nested within *Solanum* (Bohs & Olmstead, 1997; Olmstead & Palmer, 1992, 1997; Spooner et al., 1993), and all *Cyphomandra* species have now been transferred or returned to *Solanum* (Bohs, 1995), where the first described species were placed. The infrageneric taxonomy of *Solanum* is currently under study and no infrageneric rank is consistently used at present for the *Cyphomandra* group. The monophyly of the *Cyphomandra* group and the relationship of this group to others within *Solanum*, particularly its putative sister group, *Solanum* sect. *Cyphomandropsis* Bitter, are issues that need to be examined before a taxonomic designation is made.

Species of the *Cyphomandra* group have been of interest because many produce edible fruits that are gathered from the wild or grown as minor crops. The most important in this regard is *Solanum betaceum* Cavanilles, the tree tomato, which is frequently cultivated in Latin America and commonly sold in Andean markets. *Solanum betaceum* has also been an item in international commerce, usually sold under the name "tamarillo." Until recently, little was known about the place of origin of the tree tomato, which is usually regarded as being a cultigen. A group of species from Bolivia has now been identified as the closest wild relatives of *S. betaceum*, based on morphological and crossing data (Bohs, 1991, 1994). The species described here is a new member of this species complex and bears great morphological similarity to *S. betaceum*. Evidence presented below indicates that the new species is interfertile with *S. betaceum* and with two other members of the *S. betaceum* species complex.

Solanum maternum Bohs, sp. nov. TYPE: Bolivia. Santa Cruz: Prov. Caballero, Siberia–El Empalme, 5 km entrando hacia Khara Huasi, carretera entre Comarapa–Cochabamba, 17°50′S, 64°43′W, 2300 m, 8–9 May 1992 (fl, fr), *I. Vargas & E. Prado 1273* (holotype, NY; isotypes, DUKE, MO not seen, USZ not seen). Figure 1.

Solano betaceo Cavanilles affine, a quo differt corollis albo-purpureis, fructibus maturis luteis, pube paulo sparsiore, connectivis antherarum paulo latioribus.

Small tree or shrub 1–4 m tall. Branches and petioles moderately to densely puberulent with glandular and eglandular unbranched hairs less than 1 mm long. Leaf blades simple, unlobed, chartaceous, acuminate at apex, moderately puberulent adaxially, more densely so on veins, densely puberulent abaxially. Trunk leaves with blade ovate, 19–34 cm long, 15–24 cm wide, length:width ratio ca. 1.5:1, the base cordate with basal lobes 1–4 cm long; petioles 11–22 cm long. Crown leaves 4 per sympodial unit, the blade ovate, 6.5–21 cm long, 5–14 cm wide, length:width ratio ca. 1–1.5:1, the base cordate to auriculate with basal lobes 1–3 cm long; petioles 2.5–11 cm long. Inflorescence unbranched or branched, ca. 20–60-flowered, 5–10 cm long; peduncle 3–4 cm long; rachis 2–8 cm long; pedicels ca. 15–20 mm long, 20–35 mm long in fruit, ca. 1–10 mm apart, articulated above the

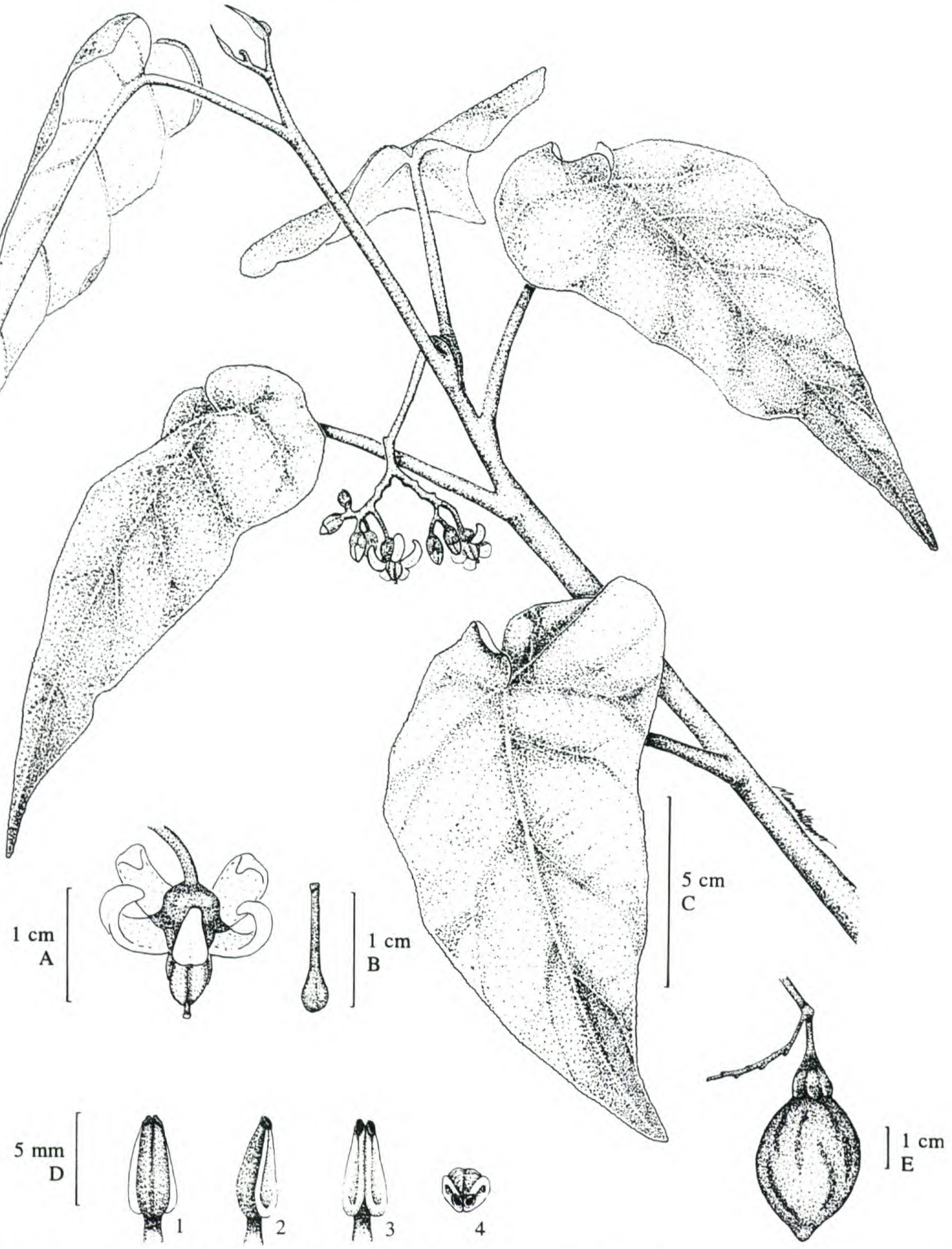

Figure 1. *Solanum maternum* Bohs. —A. Flower. —B. Gynoecium. —C. Habit. —D. Stamens (left to right, abaxial, side, adaxial, top view). —E. Fruit. All based on living material of *I. Vargas & Prado 1273.*

base, leaving pedicellar remnants up to 2 mm long; peduncle, rachis, and pedicels moderately to densely puberulent with glandular and eglandular unbranched hairs. Flower buds ellipsoidal to ovoid, obtuse to acuminate at apex. Calyx fleshy, sparsely to moderately glandular-puberulent, the radius 6–9 mm, the lobes deltate, somewhat apiculate, ca. 2–3 mm long, 2.5–3 mm wide. Corolla white to pink with a darker pink to purple star toward center, subcoriaceous, stellate, the radius 15–25 mm, the tube 2–4 mm long, the lobes triangular, 8–12 mm long, 3–5 mm wide at base, glabrous abaxially and adaxially, the margin tomentose, the apex acute. Anther thecae light yellow to cream, 5–6 mm

long, 2–3 mm wide, the pores directed distally; connective lemon yellow to light orange, ca. 4–5 mm long, 1.5–2 mm wide, narrowly triangular, abaxially somewhat shorter than the thecae at apex, slightly shorter than them at base, adaxially absent. Ovary glabrous; style cylindrical, glabrous, not dilated distally, 6–8 mm long, 0.5–1 mm wide, exserted up to 2 mm beyond anthers; stigma truncate, 0.5–1 mm diam. Fruit ellipsoidal, acute or apiculate at apex, 3–8.5 cm long, 2–5 cm diam., glabrous, yellow to orange when ripe with dark green longitudinal mottling; mesocarp with stone cell aggregates; seeds 3–4 mm long, 2.5–3 mm wide, appearing densely pubescent.

Phenology. Flowering specimens have been collected in May, September, October, and December; fruiting specimens have been collected in January, May, June, and December.

Distribution. Cloud forest at 1350–2600 m elevation in Depts. Cochabamba, La Paz, and Santa Cruz, Bolivia.

Local uses and names. Fruits edible. N.v. "pepinillo" (*Vargas & Vargas 710*), "pepino del monte" (*Nee 38493*), "tomate de monte" (*Eriksson & Vargas 3523, 3524, 3525, 3527, Vargas & Prado 1273*), "tomate lima" (*Vargas 1460*), "tomatillo" (*Eriksson & Vargas 3503*).

Etymology. The epithet "maternum" is taken from the Latin for "mother," because of the possibility that this species represents the wild ancestral form of the tree tomato.

Solanum maternum apparently belongs to a complex of closely related taxa from Bolivia, which includes *S. roseum* Bohs [formerly *Cyphomandra acuminata* Rusby], *S. unilobum* (Rusby) Bohs [formerly *Cyphomandra uniloba* Rusby], and *S. betaceum* [formerly *Cyphomandra betacea* (Cavanilles) Sendtner], the cultivated tree tomato. *Solanum maternum* is morphologically very similar to *S. betaceum*, and the two species are difficult to distinguish from herbarium material alone. Differences include slightly longer and less dense pubescence, more shallowly cordate leaves, and slightly wider anther connectives in *S. maternum*. Living material differs from *S. betaceum* in flower and fruit color. *Solanum maternum* has purplish or pinkish corollas with a deep purple star at base, whereas *S. betaceum* has uniformly white or pinkish corollas. The fruits of *S. maternum* are yellow or light orange, not dark orange or reddish as is typical of *S. betaceum*, although some forms of *S. betaceum* may have yellowish or light orange fruits. Fruits of *S. maternum* usually have a prominent apiculum or "nipple" at the distal end; those of *S. betaceum* may be acute distally, but usually lack an obvious apiculum. The reddish or purplish corollas of *S. maternum* resemble those of *S. roseum*, but the latter species is nearly glabrous and has much larger seeds than *S. maternum*. *Solanum maternum* differs from *S. unilobum* in its corolla color (*S. unilobum* has greenish corollas), its unexpanded style and small stigma, and its more abundant pubescence.

Solanum maternum grows wild in upland areas of Bolivia in the Departments of La Paz, Cochabamba, and Santa Cruz. *Solanum unilobum* also occurs in this area, but is generally found at lower elevations (300–1700 m). *Solanum roseum* has been found only farther to the northwest in the Department of La Paz, and its range is probably not sympatric with that of *S. maternum*. Thus far, definitively wild populations of *S. betaceum* have not been found. Occasional plants may persist around abandoned dwellings or sporadically escape from cultivation, but the only reports of more extensive wild stands of this species are from southern Bolivian and northwestern Argentina (Bohs, 1989; Brücher, 1968, 1977; J. Solomon, pers. comm.; E. Zardini, pers. comm.). Fieldwork is needed to fully document the wild status of these plants.

In addition to morphological similarity, crossing data have indicated a close relationship among *S. betaceum*, *S. roseum*, and *S. unilobum*. Previous crossing studies have shown that *S. betaceum* will form fertile hybrids with *S. roseum* and *S. unilobum* (Bohs, 1991), although each of these crossing combinations is successful in only one direction. Crossing data thus suggest that *S. roseum* and *S. unilobum* may have played a role in the origin of the cultivated species, *S. betaceum*. *Solanum roseum* and *S. unilobum* are self-incompatible, but all plants of *S. betaceum* examined are self-compatible. This is consistent with the observation that cultivated taxa have often evolved self-compatible breeding systems from self-incompatible ancestors (de Nettancourt, 1977; Rick, 1988).

To further understand the placement of *S. maternum*, we collected data on breeding systems and crossability of *S. maternum* with other members of the complex. These data are presented below.

Greenhouse crosses were performed with two accessions each of *S. maternum*, *S. betaceum*, and *S. unilobum* using the methods described in Bohs (1991). Provenance and voucher data can be found in Table 1. Living material of *S. roseum* was unavailable for the crossing study.

Pollen viability. Pollen viability of the *S. maternum* plants, as measured by staining in aniline blue/lactophenol, was high (91–99%) throughout the study period, with the exception of one *Vargas*

Table 1. Voucher information for plants used in the crossing study.

Species	Collector and locality	Bohs voucher number
S. betaceum	*Sperling s.n.* Ecuador. Pichincha: Quito, purchased in La Vincentina market	2274, 2275
	Nee 30359 Bolivia. Cochabamba: purchased in Cochabamba market	2468
S. maternum	*I. Vargas & Prado 1273* Bolivia. Dept. Santa Cruz: zona de San Juan del Potrero, Los Sagüintales, lado SW del Parque Nacional Amboró	2694
	I. Vargas 1460 Bolivia. Dept. Santa Cruz: Prov. Caballero, Cerro Bravo	2547
S. unilobum	*Sperling & King 5500* Bolivia. Dept. La Paz: Larecaja, between Consata and Mapiri	2283, 2284
	Eriksson & I. Vargas 3530 Bolivia. Dept. Santa Cruz: cultivated in Jardín Botánico, Santa Cruz	2549

1460 plant whose pollen stainability was 58%. Pollen stainability of the *S. betaceum* and *S. unilobum* accessions averaged 71% and 78%, respectively, lower than reported previously (Bohs, 1991).

Intraspecific crosses. No fruits were produced from 120 self-pollinations of both accessions of *S. maternum*. In contrast, 7.2% of the intraspecific sib crosses yielded fruits. Pollen tube observations were consistent with these results, with good pollen tube growth into the ovaries in sib crosses, but all pollen tube growth inhibited in the style in self-pollinations. These results indicate that the *S. maternum* accessions are self-incompatible.

A new accession of *S. unilobum* was examined during this study. Only one plant of this accession flowered during the study period, so sib crosses could not be performed. Unsuccessful pollen tube growth and lack of fruit set following self-pollinations suggest that this accession is self-incompatible.

Interaccession crosses of *S. maternum* were successful in both directions, yielding fruits with many viable seeds that subsequently germinated into F_1 hybrid plants. Many pollen tubes were seen growing into the ovary and around the ovules in these crossing combinations.

Interspecific crosses. Full-sized fruits were set in all interspecific crossing combinations among *S. maternum*, *S. betaceum*, and *S. unilobum*, but fruit set was often low (ca. 4–20% success). Likewise, pollen tube growth was uniformly successful in all directions. Vigorous F_1 hybrid plants were produced from the interspecific combinations *S. maternum* (♀) × *S. betaceum* (♂), *S. maternum* (♀) × *S. unilobum* (♂), and *S. unilobum* (♀) × *S. maternum* (♂). Seeds from the *S. betaceum* (♀) × *S. maternum* (♂) crosses usually appeared flat and misshapen, and only 3 seeds of this combination germinated from 13 fruits produced.

When these results are considered along with those of Bohs (1991), the following conclusions emerge: (1) the wild members of the complex, *S. maternum*, *S. unilobum*, and *S. roseum*, are self-incompatible, whereas all accessions of the putative cultigen *S. betaceum* that have been examined are self-compatible, and (2) all species of the complex that have been tested are interfertile to some extent. The high degree of morphological similarity among the taxa on herbarium sheets precludes speculation about the degree of natural hybridization among members of the complex. Additional fieldwork is needed to sort out morphological differences among living plants that are not evident in dried material, and other accessions, particularly of *S. maternum* and *S. betaceum*, should be examined for self-incompatibility. The geographical distributions of the taxa of the complex also need to be documented in detail to determine if plants of these taxa are indeed sympatric and can thus exchange genes in nature.

Accumulating evidence suggests that *S. maternum*, *S. unilobum*, and/or *S. roseum* may have been

involved in the origin of the tree tomato, *S. betaceum*. Questions that remain concern the status of *S. betaceum* as a cultigen and the exact series of events that have led to its evolution. The close morphological resemblance of *S. maternum* to *S. betaceum* and its self-incompatible breeding system suggests that *S. maternum* may be the wild ancestral form of the tree tomato. However, more field, greenhouse, and laboratory work needs to be done to support this hypothesis. *Solanum maternum* should be explored as a source of useful genes for improvement of the tree tomato, and may itself be valuable as an economic fruit crop.

Paratypes. BOLIVIA. **Cochabamba:** Prov. Carrasco, Serranía Siberia, 20–35 km W of Comarapa on the old Cochabamba–Santa Cruz road (Hwy. 4), ca. 2000 m, 14–15 Jan. 1990 (fr), *Dorr & Barnett 7038* (MO, NY). **La Paz:** Prov. Sud Yungas, 7 km de Huancané en carretera a San Isidro, 16°21′S, 67°31′W, 2300 m, 13 Dec. 1989 (fr), *D. N. Smith et al. 13920* (NY). **Santa Cruz:** Prov. Caballero, Santa Rosa, 17°52′S, 64°12′W, 2100 m, 3 May 1993 (fr), *Eriksson & I. Vargas 3503, 3504* (NY), 5 km NE Río Lapacha, 1900 m, 4 May 1993 (fr), *Eriksson & I. Vargas 3507* (NY), 1800 m, *Eriksson & I. Vargas 3508* (NY); Prov. Caballero, Verdesillo, 17°50′S, 64°33′W, 2400 m, 10 May 1993 (fr), *Eriksson & I. Vargas 3523, 3524, 3525* (NY); Prov. Caballero, Locotal, 17°45′S, 64°45′W, 2230 m, 10 May 1993 (fl, fr), *Eriksson & I. Vargas 3527* (NY); Prov. Caballero, Parque Nacional Amboró, Cerro Bravo, cerca Comarapa, 2600 m, 17 June 1995 (fr), *Jardim et al. 1987* (MO, NY); Prov. Caballero, entre 15 y 25 km al N de San Juan de Potrero, hacia Cerro Bravo, 17°48′S, 64°15′W, 2000–2500 m, 6 June 1992 (fr), *Killeen & I. Vargas 4068* (MO, NY), *4112* (MO, NY); Prov. Florida, 5 km SW of Yerba Buena, top of ridge at upper reaches of Quebrada Agua Blanca, 18°01′S, 64°03′W, 1900–1950 m, 23 Dec. 1989 (fl), *Nee & I. Vargas 38287* (NY); Prov. Vallegrande, SW side of Los Sitanos and along Quebrada Seca, 18°52′S, 63°57′30″W, 1350 m, 27 Dec. 1989 (fl, fr), *Nee 38493* (NY); Prov. Florida, 7 km (by air) NE of Mairana, on dirt road NE of "Yungas," 18°05′S, 63°55′W, 2100 m, 2 June 1991 (fr), *Nee 40694* (NY); Prov. Vallegrande, Alto Seco, 21 km SE (línea recta) de Pucará, 18°53′S, 64°05′W, 2163 m, 13 May 1988 (fl, fr), *Saldias 351* (NY); Prov. Caballero, 50 km al N de Mataral (en la carretera Santa Cruz–Comarapa) pasando por San Juan del Potrero y bajando a la cuenca del alto Río Ichilo, 2000–2100 m, 26 May 1989 (fl, fr), *Quintana & García 13429* (NY); Prov. Vallegrande, La Centinela y Tupiriqui (La Yunga), 15 km SE linea recta de Piraimirí, 18°40′S, 63°48′W, 1500 m, 3 Sep. 1990 (fl), *I. Vargas & E. Vargas 710* (NY); zona de San Juan del Potrero, Los Sagüintales, lado SW del Parque Amboró, *I. Vargas 1322* (NY, USZ); Prov. Caballero, Cerro Bravo, ca. 2000 m, 10 June 1992, *I. Vargas 1460* (NY, USZ); Prov. Florida, Parque Nacional Amboró, La Yunga, trayecto entre Chape y el Corral, 8–10 km al NE de Mairana, senda de la Yunga hacia el Río San Rafael, 18°04′S, 63°53′W, 2300 m, 23 May 1993 (fr), *I. Vargas et al. 2513* (NY); Prov. Caballero, Parque Nacional Amboró, proximidades del Cerro Bravo a 10 km al N de Comarapa, alrededores de la Parcela permanente, 17°49.5′S, 64°32.5′W, 2400–2600 m, 18–25 Oct. 1993 (fl), *I. Vargas & Jardim 2947* (NY); Prov. Vallegrande, Monte Paulo, 4–5 km SE de Piraymirí sobre la carretera a Mascicurí, 18°39.4′ S, 63°56′W, 2160 m, 27 Dec. 1994 (fl), *I. Vargas & V. Vargas 3688* (NY).

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Studies in Annonaceae XXXII. A Peculiar New Species of *Malmea* (Annonaceae) from Panama and Colombia

Lars W. Chatrou

Herbarium Division, Department of Plant Ecology and Evolutionary Biology, Utrecht University, Heidelberglaan 2, 3584 CS Utrecht, the Netherlands

ABSTRACT. In the framework of the multidisciplinary Annonaceae Project, a monograph of the neotropical genus *Malmea* is being prepared by the author. A new species of *Malmea* with dimerous flowers, exceptional for Annonaceae, is here described. An overview of deviations from the typical trimerous annonaceous perianth is given for the Neotropics.

One of the characteristic features of Annonaceae is a perianth consisting of one whorl of three sepals, and two whorls of three petals each. In the Neotropics, variation in number of perianth parts sometimes appears, and has for example been reported for *Cymbopetalum* (Murray, 1993) and *Rollinia mucosa* (Jacquin) Baillon (Murray & Johnson, 1987). In these cases, however, the variation is of no taxonomic significance. Maas et al. (1986) were unable to pronounce upon the constancy of dimerous whorls of sepals and petals in the Brazilian species *Anaxagorea silvatica* R. E. Fries as only one flowering collection is known.

In Annonaceae most deviations from the general pattern of the perianth that do have diagnostic value for species and genera occur in Africa and Asia (van Heusden, 1992). In the Neotropics only a few deviations occur. In several sections of *Annona* the inner whorl of petals is lacking (or rudimentary). Another exceptional species, *Annona phaeoclados* Martius, has a variable number of petals, arranged spirally (see Spichiger & Mascherpa, 1983). The position of this species within *Annona* is doubtful, and it may be transferred to *Duguetia* (Maas & Rainer, pers. comm.). At the generic level *Tetrameranthus* (5 species) and *Tridimeris* (1 species, and 2 unpublished species; Schatz, 1987) are characterized by their tetramerous and dimerous flowers, respectively.

Within the scope of the international Annonaceae Project the genus *Malmea*, with 18 currently described, all trimerous species, is now under revision. *Malmea dimera* Chatrou, the third dimerous species for the Neotropics, after *Anaxagorea silvatica* and *Tridimeris hahniana* Baillon, is described here.

Malmea dimera Chatrou, sp. nov. TYPE: Panama. Panamá: Cerro Azul, ca. 1 km before Lago Goofy, 20 Nov. 1983 (yfl, fr), *Correa A. et al. 4367* (holotype, PMA; isotypes, F, MO, NY, U). Figure 1A–E.

Arbor usque ad 15 m alta. Ramuli novelli ut facies abaxialis petiolorum costarumque pilis fuscis adpressis obtecti. Folia (anguste) elliptica, 11–18 cm longa et 3–6 cm lata, costa supra impressa, subtus carinata. Inflorescentiae terminales vel oppositifoliae aut supra-axillares; pedunculi, bracteae et pedicelli pilis ut in ramulis vestiti. Flores dimeri. Petala et sepala ciliata. Monocarpia 25–60, fusca vel picea in vivo. Semina nitida, foveolata.

Tree (or treelet), 3–15 m tall, to 8 cm diam. Young twigs and abaxial side of petiole, primary vein, and lamina covered with brown, appressed hairs (0.1–)0.2(–0.4) mm long (simply called hairs hereafter). Petioles 4–6 mm long, 1.5–2 mm diam., canaliculate. Lamina (narrowly) elliptic (to (narrowly) obovate), (7–)11–18(–22) cm long, (2.5–)3–6 (–7.5) cm wide, length/width ratio (2–)2.3–3.3(–4), olive green to grayish green, shiny, base attenuate (to acute), apex gradually acuminate (acumen 5–20 mm long). Venation brochidodromous, all intercostal areas fully closed, primary vein on upper side immersed proximally to slightly raised distally, on lower side raised and carinate, (8–)9–11(–13) secondary veins on either side of primary vein, angle with primary vein 60–80°, curving abruptly to form loops at obtuse to right angles, tertiary loops indistinct, shortest distance between loops and margin 3–7 mm, intersecondaries present in almost every intercosta, length 50–100% of intercosta. Inflorescence terminal, leaf-opposed, or supra-axillary, maximally two flower scars and two actual flowers on rhipidium. Peduncles, bracts, and pedicels hairy. Peduncles 3–10 mm long, 0.5–2 mm diam. Pedicels 12–31 mm long, 1 mm diam. proximally to 2 mm distally, fruiting pedicels to 4 mm diam. distally. Bracts two, one bract 1–2 mm below articulation, 1.5–3 mm long, ovate-triangular, obtuse, caducous, one bract at 50–90% from the base of pedicel, 1.5 mm long, transversely broadly ovate-triangular, obtuse to rounded, semi-amplectent.

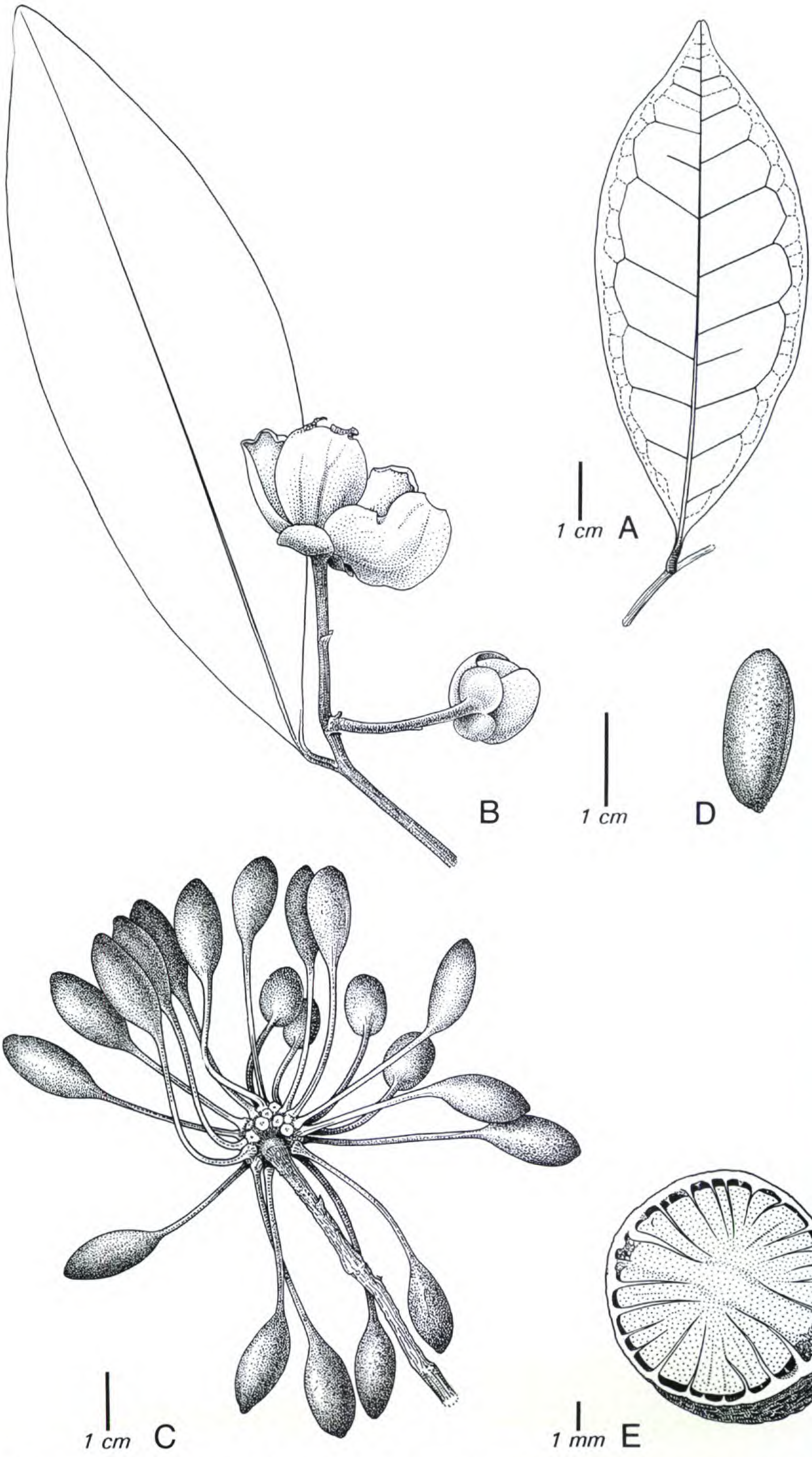

Figure 1. *Malmea dimera* Chatrou. —A. Leaf. —B. Terminal, two-flowered inflorescence. —C. Fruit. —D. Seed. —E. Cross section of seed, showing spiniform ruminations. A, C, D, E, *Foster & Kennedy 2009*; B, *Duke & Bristan 8188*.

Flowers bisexual, only 2 mature flowers observed. Sepals transversely broadly elliptic to transversely broadly ovate, 3–4.5 mm long, 5–6 mm wide, ciliate, outer side glabrous to sparsely hairy, inner side glabrous. Outer petals (broadly) elliptic with convex margins, 15 mm long, 12 mm wide, ciliate, glabrous on both sides. Inner petals broadly elliptic with convex margins, 13 mm long, 12 mm wide, ciliate, glabrous on both sides. Staminate portion of torus glabrous, carpellate portion of torus hairy. Stamens ca. 150, 1.5–2 mm long, thecae 1 mm long. Carpels ca. 25, 1.5 mm long, densely hairy. Fruit green, maturing dark brown to black (in vivo). Fruiting receptacle (sub)globose, 7–15 mm diam., sparsely hairy to glabrous. Monocarps 25–60, ellipsoid, 16–20 mm long, 7–9 mm diam., glabrous to sparsely hairy, verrucose when immature (in sicco), fruit wall ca. 0.2 mm thick; stipes, 21–28(–34) mm long, 1 mm diam. to 2 mm distally, glabrous to sparsely hairy, with one longitudinal groove. Seeds ellipsoid, 16–18 mm long, 6–8 mm diam., (reddish) brown, shiny, pitted, raphe a slightly elevated rib, ruminations spiniform.

Distribution. *Malmea dimera* is distributed in the Panamanian provinces of Panamá and Darién and the Colombian states of Antioquia and Chocó.

Habitat. Disturbed forest and on riverbanks, at elevations to 250 m. Flowering from April to November, fruiting the whole year round.

Local names and uses. Yaya Laguna, Guanabana torete (Darién, Panamá). The Bayano Cuna (Panamá) use the plant medicinally (purpose not reported) and call it Huichurgola.

The bark is reported to contain latex (*Duke 367*). On some collections the appearance of a typical odor of the bark is mentioned, described as "pungent scent," "peppery aroma," or "lemon disinfectant smell."

There is no doubt about the constancy of appearance of dimerous flowers. Of 23 collections, 15 had flowers or flower buds, all of which are dimerous. This aberrant feature for annonaceous flowers has not been remarked on by any collector. Probably this is due to the fact that hardly any mature flowers, but mostly young buds, have been collected.

Malmea dimera most closely resembles Peruvian *M. dielsiana*, and *M. obovata* from the Brazilian state of Bahia, which are both trimerous species. The leaves of these three species are almost indistinguishable. Apart from the number of sepals and petals, the indument of the monocarps helps to distinguish *M. dimera* from *M. dielsiana*: glabrous to sparsely hairy in *M. dimera* and densely hairy in *M. dielsiana*. Additional differences between *M. dimera* and *M. obovata* are a longer pedicel, and longer trichomes on young twigs, leaves, and inflorescences of the latter species.

In contrast to the recently described *M. surinamensis* (Maas & Chatrou, 1995), which mostly has subaxillary inflorescences, a supra-axillary position of the inflorescence is sometimes encountered in *M. dimera*. This position is due to concaulescence of twig and petiole. Grooves indicating the area of concaulescence can be seen in those cases. On older twigs, inflorescences of *M. dimera* sometimes seem to be axillary. Careful study of the morphology shows that the true position is a terminal one on a strongly reduced axillary twig. Therefore, the position of these inflorescences is regarded as terminal.

Paratypes. PANAMA. **Darién:** 2–3 km W of Canglon and 1 km SW of Pan American Hwy., alt. 50–100 m, 4 Nov. 1982 (fr), *Alverson et al. 1968* (WIS); Canglon, without date (fr), *Duke & Bristan 360* (MO), without date (yfl), *Duke & Bristan 367* (MO); without locality, without date (fl), *Duke & Bristan 8188* (MO); Río Pirre, Apr. 1966 (yfl), *Duke & Bristan 8249* (MO); Cuna Reservation, Río Morti, 10 km upstream from Morti Arriba, alt. 50–90 m, 24 July 1966 (yfr), *Duke 8444* (DUKE, MO); between Paya and Palo de las Letras, 30 Aug. 1967 (fl), *Duke & Kirkbride 14025* (MO); Drill Site 7, Río Morti, alt. 250 m, 18 Sep. 1967 (yfl), *Duke 14175* (F, MO, NY); Ensenada del Guayabo, 18 km SE of Jaqué, alt. 25 m, 10 Jan. 1983 (fr), *Garwood et al. 104* (BM, MO); Río La Marea, alt. 5–50 m, 28–30 June 1969 (fr), *Holdridge 6303* (MO); RENARE hut in Darién National Park, alt. 20 m, 7 Aug. 1986 (yfl, fr), *McDonagh et al. 554* (BM, MO). **Panamá:** Río Majé, along river from waterfalls near Bayano Lake to Finca of Chocó Indian Eduardo Maycha, alt. 30–60 m, 4 May 1976 (yfl), *Croat 34603A* (MO); between Río Majé and Quebrada Brava, alt. 60 m, 4 May 1976 (fl), *Croat 34626* (F, MO, U); Río Bayano, near crossing of Pan American Hwy., above confluence with Río Chepo, 27 Sep. 1961 (yfl, fr), *Duke 3978* (MO); between Cañasas and Sabalo, alt. 100 m, 26 Sep. 1967 (yfl, fr), *Duke 14450* (MO); Majé, on Choco Indian trail ca. 8 km up the Río Majé, alt. 200 m, 18 Nov. 1970 (yfl, fr), *Foster & Kennedy 2009* (DUKE, MO, WIS); Lago Bayano, Isla Majé, trail behind Gorgas station, 16 June 1982 (yfl), *Foster 3922* (F); Cerro Azul, 25 Sep. 1986 (fr), *Valdespino & Solis 152* (U). COLOMBIA. **Antioquia:** Mun. Carepa, 45 km S of Turbo, reserva forestal Tulenapa ICA, alt. 20 m, 31 July 1987 (yfl), *Callejas et al. 4863* (MO, U); Mun. Turbo, ENE of Turbo, 11 km from Currulao, alt. 45 m, 3 Aug. 1987 (yfl, fr), *Callejas et al. 4973* (COL, MO, U). **Chocó:** bank of Río Truandó, 20 km W of Ríosucio, 19 Mar. 1958 (fr), *Bernal 25* (COL); Mun. Acandí, Vereda Coquital, alt. 150–200 m, 23 May 1989 (yfr), *Fonnegra et al. 2849* (U).

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A New Species of *Sinojackia* Hu (Styracaceae) from Zhejiang, East China

CHEN Tao

Herbarium, South China Institute of Botany, Chinese Academy of Sciences, Guangzhou, Guangdong 510650, People's Republic of China

LI Gen-you

Department of Forestry, Zhejiang Forestry College, Linan, Zhejiang 311300, People's Republic of China

ABSTRACT. The new species *Sinojackia microcarpa* C. T. Chen & G. Y. Li is described and illustrated, and the characters distinguishing it from the related species *S. rehderiana* are given.

Sinojackia Hu is a Chinese endemic genus of about five species. It was described by Hu (1928) based on *S. xylocarpa*, which was collected from Jiangsu. Hu (1930) added *S. rehderiana* from Jiangxi, Merrill (1937) transferred *Pterostyrax henryi* to *Sinojackia*, Qi (1981) described *S. dolichocarpa* from Hunan, and Luo (1992) described *S. sarcocarpa* from Sichuan. Chen (1995) transferred *S. dolichocarpa* to the monotypic *Changiostyrax* because it has an unarmed trunk, scaly buds, 4-merous, ebracteate flowers, a truncate calyx tube, 8 equal stamens, anthers without prolonged connectives, and other features not found in *Sinojackia*. The following new species was discovered in Zhejiang Province during recent field surveys in connection with studies on the phytogeography of Styracaceae.

Sinojackia microcarpa C. T. Chen & G. Y. Li, sp. nov. TYPE: China. Zhejiang: Jiangde Co., Meicheng, Wushitan, bushes along stream, 40 m, ca. 29.5 N, 119.5 E, 6 Nov. 1995, *C. T. Chen 9511041* (holotype, IBSC; isotype, MO). Figures 1–12.

Species *S. rehderianae* Hu simillima, sed fructu parviore, 3–4 mm diametro, leviter 6–12-costato, mesocarpio neque incrassato neque suberoso differt.

Shrubs deciduous, to 3 m high; trunk thorny, 2–4 cm DBH; bark grayish brown, longitudinally fissured. Current year's shoots green, densely stellate-pubescent, second year's branches blackish brown, glabrous, longitudinally striate, bark vertically fissured and peeling off. Buds with orbicular green scales, densely stellate-pubescent. Leaves alternate, simple, papery; petiole 3–4 mm long; blade ovate to elliptic, 6–12 cm long, 2.5–6 cm wide, apex acuminate, base broadly cuneate or rounded, margins remotely glandular-serrulate, with 8–10 lateral veins on each side of midrib; young leaves sparsely stellate-pubescent abaxially and along veins adaxially, glabrescent, prominently and closely reticulate adaxially, smoother and more shiny green abaxially. Inflorescences densely racemose, 3–7-flowered, 4–8 cm long, produced laterally at nodes on second year's branches; rachis and pedicels slender, densely stellate-pubescent; pedicels 3–17 mm long. Flowers bisexual, ± pendulous, stellate-pubescent on most parts except style, the basal 1–3 in each inflorescence subtended by a leafy bract; bracts with petiole 1–2 mm long, blade 2.5–5 cm long, base rounded to subcordate; uppermost flowers with a small lanceolate bract adnate to pedicel, rarely ebracteate. Calyx (5)6(7)-dentate; teeth triangular, 1–2 mm long, 0.8–1 mm wide at base. Corolla white, deeply 6(7)-parted; lobes imbricate, oblong-lanceolate, 7–8 mm long, 2–3 mm wide, curved at apex. Stamens 12(–14), unequal, free portion 5–6 mm long; filaments curved, slightly arcuate, united at base; anthers oblong, longitudinally dehiscent, connective shortly produced. Ovary inferior, 3-locular; ovules 4–8 in each locule, biseriate; style terminal, slender, glabrous, 5–8 mm long; stigma obscurely 3-lobed. Fruit indehiscent, fusiform, grayish brown, 6–12-ribbed when dry, 1.5–2 cm long, 3–4 mm diam., tapered at base, apex subulate, beaked, the beak 0.5–1 cm long; exocarp thin, sparsely stellate-pubescent; mesocarp undeveloped; endocarp thin, bony; seed solitary, ca. 1 cm long; seed coat smooth. Fruiting pedicel 0.5–2 cm long.

Flowering March–April.

Sinojackia microcarpa is similar to *S. rehderiana* Hu in fruit morphology, but differs in having smaller fruit 3–4 mm in diameter, 6–12-ribbed when dry,

Figures 1–12. *Sinojackia microcarpa* C. T. Chen & G. Y. Li. —1. Flowering branch. —2. Portion of abaxial leaf surface. —3. Thorn. —4. Flower. —5. Opened calyx showing androecium. —6, 7. Stamens. —8. Stigma. —9. Longitudinal section of ovary. —10. Cross section of ovary. —11. Fruit. —12. Cross section of fruit. Scale for Figures 1 and 3 = 3 cm; 2 = 1 cm; 4–7, 9 = 3 mm; 8 and 10 = 0.5 mm; 11 = 7 mm; 12 = 3 mm.

and in lacking the mesocarp. In contrast, *S. rehderiana* has larger (5.5–6 mm diam.), unribbed fruit with thickened, corky mesocarp.

Sinojackia microcarpa is the first representative of *Sinojackia* recorded from Zhejiang Province. It is a very rare species confined to stream sides in a small valley at altitudes of 25–200 m. Its white and showy flowers should be of ornamental value. Mature seeds are eaten by birds.

Paratypes. CHINA. **Zhejiang:** Jiangde Co., bushes along stream, 30 m, 10 May 1995, *C. T. Chen 9505033* (IBSC, MO), 25 m, 4 Apr. 1989, *G. Y. Li et al. 0155* (ZJFC), 40 m, 28 Aug. 1989, *G. Y. Li et al. 0158* (ZJFC), 40 m, 4 Oct. 1989, *L. Din & M. Wang 0172* (ZJFC).

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Podandrogyne hispidula, *P. jamesonii*, and *P. mathewsii* (Capparidaceae), Three Valid Species from Ecuador and Peru

Theodore S. Cochrane
Department of Botany, University of Wisconsin, 430 Lincoln Drive, Madison, Wisconsin 53706, U.S.A.

ABSTRACT. New combinations are made for three mostly allopatric species formerly included in *Podandrogyne brachycarpa: P. hispidula*, *P. jamesonii*, and *P. mathewsii*.

Podandrogyne is a taxonomically complicated neotropical genus of about 26 species that has long been in need of revision. An outdated provisional synopsis to the species (Woodson, 1948) is the only comprehensive account available, and there are no regional treatments for Colombia and Ecuador, two countries with the highest concentration of taxa. In Ecuador alone there are 11 species, 5 of which remain undescribed.

The following nomenclatural changes involve several populations from Ecuador and Peru, all long believed (Brako & Zarucchi, 1993; Woodson, 1948) to be synonymous with *Podandrogyne brachycarpa* (DC.) Woodson sensu lato, the most abundant and taxonomically variable taxon in the genus, generally characterized by the presence of compound leaves, foliaceous bracts, and oblong to ovoid fruits. However, from observation of herbarium specimens, I have concluded that *P. hispidula*, *P. jamesonii*, and *P. mathewsii*, although very closely related to one another, are clearly distinct, with neither any real overlap in geography nor any intergradation in morphology. In fact, nearly all Peruvian collections previously named *P. brachycarpa* belong to either *P. hispidula* or *P. mathewsii* (only two collections from Dept. Amazonas are true *P. brachycarpa*), while material from Ecuador is mostly *P. brachycarpa* and partly a new species to be described.

Two of the following new combinations are needed for the account of the Capparidaceae in the forthcoming *Catalogue of the Vascular Plants of Ecuador*.

Podandrogyne hispidula (DC.) Cochrane, comb. nov. Basionym: *Gynandropsis hispidula* DC., Prodr. 1: 238. 1824. TYPE: Peru. [Junin:] Pueblo Nuevo, *Pavón s.n.* Original labels read: "Cleome hirsuta Peru," "Cleome coccinea in Peruvia Ruiz," and "E Peruvia [Herb.] Pavon," (holotype, G; fragments of holotype, F, WIS; photos of holotype, GH, NY, US, WIS; isotypes, B, BM, G, HAL, MA not seen, P; fragment of MA isotype, F).

Podandrogyne hispidula is characterized by its relatively sparse hispidulous pubescence on the inflorescences (vegetative parts range from sparsely hispidulous to densely velutinous), persistent small bracts, large number of bisexual flowers, glabrous sepals, copiously villous-tomentulose ovaries, and hispidulous capsules. It occurs from the much-traveled Tingo María (Dept. Huánuco)–Pucallpa (Loreto) road southward through Junin to Cuzco, partly overlapping the range of *P. mathewsii* subsp. *mathewsii*.

Podandrogyne jamesonii (Briquet) Cochrane, comb. nov. Basionym: *Gynandropsis jamesonii* Briquet, Annuaire Conserv. Jard. Bot. Genève 17: 388. 1914. TYPE: Ecuador. "461 Leguminosa Foot of the Cuesta of Angas 1000 feet above the sea level Ecuador Jameson 1847" (holotype, G; fragment of holotype, F; photos of holotype, GH, MO, NY, US, WIS; isotypes, BM, G, K, US).

Podandrogyne jamesonii is a perfectly distinct species characterized by a lax, pliantly divergent raceme with a slender rachis; small, bright red flowers (pedicel, calyx, and corolla); and small, narrowly oblong or sometimes rhomboid fruits. Somewhat similar plants occur regularly among the large quantity of herbarium material that has been identified over the years as *P. brachycarpa*, but none have inflorescences that are as flexible, delicate, or loosely flowered, and these characters in conjunction with the arcuate-spreading pedicels and short, triangular sepals (basally connate and apically much less acute) help separate *P. jamesonii* from the remainder of the "brachycarpa" group of *Podandrogyne*. The species ranges from southernmost Prov. Esmeraldas southward throughout much of the *Región Occidental* to Guayas and northern Azuay.

Podandrogyne mathewsii (Briquet) Cochrane, comb. nov. Basionym: *Gynandropsis mathewsii* Briquet, Annuaire Conserv. Jard. Bot. Genève 17: 387. 1914. TYPE: Peru. [Huánuco:] "193 Casapi," 1835, *Mathews 193* (holotype, G; fragment of holotype, F; photos of holotype, GH, NY, US, WIS; isotypes: LE, P—2 sheets). Specimens precisely matching one another were distributed as "Cleome 193," "Cleome 2021" (BM, CGE—2 sheets, E), and "leg. Matthews [sic] no. [or nr.] 679" (GOET). It might be assumed that some or all of these specimens, at least those bearing the numbers 193 and 2021, are part of the type collection, because both numbers appear, albeit in different inks, on the same label on a sheet of *P. mathewsii* in LE.

Podandrogyne mathewsii can be identified by its narrow glandular-puberulent sepals, which taper very gradually to the tip (and are often wrinkled in herbarium material) and usually equal or exceed the red corolla. In addition, *P. mathewsii* has ovoid- or oval-oblong fruits. It is similar and probably closely related to *P. hispidula*, also of Peru, but comes nearest to *P. brachycarpa* sensu stricto, the most widely distributed species of the "brachycarpa" group. *Podandrogyne brachycarpa* is also pubescent and often possesses bracts, but can be distinguished by its orange flowers, the sepals of which are much shorter than the petals, are connate at the base, subacuminate and sharp at the tips (but not attenuate), and more or less puberulent, at least near the base and toward the midnerve. In addition, *P. brachycarpa* usually has narrowly oblong fruits, whereas *P. mathewsii* has slightly compressed ovoid- or oval-oblong fruits.

Podandrogyne mathewsii subsp. **ulei** (Briquet) Cochrane, comb. et stat. nov. Basionym: *Gynandropsis ulei* Briquet, Annuaire Conserv. Jard. Bot. Genève 17: 385. 1914. TYPE: Peru. Loreto: "Im Walde des Pongo de Chilcayo, Tarapoto," Nov. 1902 (fl, fr), *Ule 6430* (holotype, G; isotypes, B, L; photos of B isotype, F, GH, NY, US, WIS).

There are two variants among herbarium specimens. *Podandrogyne mathewsii* subsp. *ulei*, representing one extreme, might warrant recognition as a full species based on more study of a larger series of collections. From *P. mathewsii* subsp. *mathewsii* these specimens differ in tending to be more pubescent, to have ovate-oblong rather than suborbicular flowers, and sepals (7–16 rather than 4–9 mm) and petals (8–13 vs. 5–9 mm) that are longer. In fact, sepal length is more variable in *P. mathewsii* subsp. *ulei*, namely from 1–5 mm shorter than to 1–3 mm longer than the petals instead of equaling to 1–3 mm shorter than the petals as in typical *P. mathewsii*. However, flower size and absolute and relative sepal lengths appear to show continuous variation within this species when treated broadly. Incomplete differentiation into a more robust entity with slightly larger flowers and fruits and coarser pubescence and one that is of average stature with finely hairy stems and leaves is parallel to the clinal situation found in *P. densiflora* (Bentham) H. H. Iltis & Cochrane, which ranges from Colombia into Venezuela.

Typical *Podandrogyne mathewsii* subsp. *mathewsii* ranges from southern Dept. San Martín to southern Cuzco, while *P. mathewsii* subsp. *ulei* occurs mostly in northern San Martín and reappears in Junin and south-central Ecuador. Only one of the five collections from Ecuador bears a fruit, and only two have expanded flowers, but in all the racemes are like those of *P. mathewsii*. The large flower buds with their subcaudate, glandular-puberulent sepals (11–16 mm long, from just equaling to usually exceeding the petals by up to 4 mm) are typical of the "ulei" type. The pistillate flowers have androgynophores 12–14 mm long and gynophores 4–5 mm long.

There is a unique collection made in 1944 in the vicinity of Indanza, Prov. Morona-Santiago, Ecuador (*Jørgensen OHJ-42*, NY), which deserves special comment. It has the large flowers typical of plants of eastern Peru and eastern Ecuador, but its capsules are 4-valved, a most unusual condition. The presence of four placentae, previously unknown in the Cleomoideae and rare in several genera of woody Capparidaceae, suggests that in this abnormal plant there must have been a teratological shift from two to four carpels. Rare as it is, this condition may nevertheless be due to a simple mutation.

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Taxonomic Changes in *Carex* (Section *Scirpinae*, Cyperaceae)

Debra A. Dunlop
Biology Department, New England College, Henniker, New Hampshire 03242, U.S.A.

ABSTRACT. *Carex scirpoidea* Michaux var. *convoluta* Kükenthal and *C. scirpoidea* Michaux var. *pseudoscirpoidea* (Rydberg) Cronquist are herein recognized and elevated to subspecies, and *Carex scabriuscula* Mackenzie and *Carex gigas* (Holm) Mackenzie are treated as synonyms.

During the course of preparing a treatment of *Carex* sect. *Scirpinae* (Cyperaceae) for a forthcoming volume of the *Flora of North America*, it has become necessary to publish a change of rank for two combinations and make a note of synonymy. *Carex scirpoidea* Michaux var. *convoluta* Kükenthal and *C. scirpoidea* Michaux var. *pseudoscirpoidea* (Rydberg) Cronquist are herein recognized and elevated to subspecies, and *Carex scabriuscula* Mackenzie and *Carex gigas* (Holm) Mackenzie are treated as synonyms.

Carex sect. *Scirpinae* is a group of North American sedges (except for one population of *Carex scirpoidea* subsp. *scirpoidea* that grows in Norway) that possesses a dioecious breeding system, unispicate inflorescence, and pubescent perigynia. The section includes *Carex scirpoidea* and its four subspecies (subsp. *scirpoidea*, subsp. *stenochlaena* (Holm) Löve & Löve and the two proposed herein), *Carex curatorum* Stacey from Utah and Arizona, and *Carex scabriuscula* from Oregon and California.

Based on the results of a biosystematic study (Dunlop, 1990), *Carex scirpoidea* is recognized as a geographically wide-ranging species with four subspecies. Subspecies in *C. scirpoidea* are geographically based ecotypes that share a common chromosome number, possess similar achene micromorphology and leaf anatomy, interbreed in greenhouse experiments, and have the majority of morphological characters falling within the normal range for *C. scirpoidea* but differ morphologically in only a few characters. Here, I propose that *C. scirpoidea* var. *convoluta* and *C. scirpoidea* var. *pseudoscirpoidea* be elevated to the rank of subspecies as they satisfy the criteria mentioned above.

Carex scirpoidea subsp. **convoluta** (Kükenthal) D. A. Dunlop, stat. nov. Basionym: *Carex scirpoidea* var. *convoluta* Kükenthal, in Engler, Pflanzenreich 38(IV: 20): 81. 1909. TYPE: U.S.A. Michigan: Thunder Bay Island, 18 July 1895, *Wheeler s.n.* (holotype, B destroyed; isotypes, BH, CAN, GH, MICH, MIN, MSC, NY, POM, US, VT).

Plants caespitose, lacking short creeping rhizomes. Flowering shoots lacking the persistent sheaths and bases of the previous years' leaves, erect. Vegetative leaves to 23 cm × 1.8 mm. Subtending scales ovate, 2.4 × 1.2 mm. Perigynia ovate, 1.5–2.6 × 1–1.2 mm, tightly enveloping the fruits for the entire length and width. Fruits 1–1.5 mm × 0.6–0.9 mm.

Plants flowering from May to July and fruit from late June to September. *Carex scirpoidea* subsp. *convoluta* occurs in alvar communities (glacial scoured limestone pavements with shallow soil) along the Bruce Peninsula and island shores of Lake Huron. This subspecies is restricted to Ontario and Michigan; subspecies *scirpoidea* also occurs inland infrequently in the Great Lakes region.

Subspecies *convoluta* is geographically the most restricted subspecies of *Carex scirpoidea* and is distinguished by narrowly V-shaped leaves, especially of the flowering shoot, a strongly caespitose habit, and conspicuously more flowering shoots per plant than other subspecies.

These narrow-leaved plants were first described as a variety of *Carex scirpoidea* by Kükenthal based on specimens collected by Wheeler in 1895 from Thunder Bay Island, Michigan. Isotypes are available of Wheeler's 1895, Thunder Bay Island, Michigan, collections since Kükenthal's *Carex* herbarium, presumably including the holotype of *C. scirpoidea* var. *convoluta*, was sent to Berlin (B) and was destroyed during World War II (Stafleu & Cowan, 1979).

Carex scirpoidea Michaux subsp. **pseudoscirpoidea** (Rydberg) D. A. Dunlop, stat. nov. Basionym: *Carex pseudoscirpoidea* Rydberg, Mem. New York Bot. Gard. 1: 78. 1900. *Carex scirpoidea* var. *pseudoscirpoidea* (Rydberg) Cronquist, Univ. Wash. Publ. Biol. 17: (1): 325. 1969. TYPE: U.S.A. Montana: Spanish Basin, July 1896, *Rydberg 3064* (lectotype, designated by Mackenzie (1935), NY).

Plants rhizomatous. Flowering shoots with persistent sheaths and bases of the previous years' leaves, erect. Vegetative leaves to 21 cm × 3 mm. Subtending scales ovate, 2.8 × 1.5 mm. Perigynia ovate, (1.5)2.0–2.8(3) × 1.5 mm, tightly enveloping the fruits for the entire length. Fruits 1.5–1.8 × 0.9–1.2 mm.

Plants generally flower from June to September, depending on elevation. Subspecies *pseudoscirpoidea* occurs at elevations from 3300 to 3900 m, on dry ridge sites, fellfields with gravelly and non-calcareous soils in contrast to the relatively lower elevation, wetter sites with calcareous soils of *Carex scirpoidea* subsp. *scirpoidea.* Subspecies *pseudoscirpoidea* is found in British Columbia, California (Sierra Nevada Range), Colorado (San Juan Mountains), Idaho (Sawtooth Range), Montana (Little Belts, Anaconda-Pintlar Range, and Beartooth Plateau), Oregon (Steen Mountains), Utah (Uinta and La Salle Mountains), and Washington (Okanagan Range).

Carex scirpoidea subsp. *pseudoscirpoidea* is a distinct ecological entity occurring in high-elevation sites in various mountain ranges in the West. This taxon is distinguished by culms that arise from second-year shoots that are clothed at the base by the withered and persistent leaf bases of the previous year. Generally, one culm arises from a single node and internodes of the rhizome are elongated, typically 1–2 cm. The leaves are clustered, diverging from the shoot axis at one point approximately 10–20 mm above the rhizome, in contrast to other taxa in which the leaves diverge from the stem at scattered intervals along the shoot axis. The plants generally have shorter and wider leaves than those of *C. scirpoidea* subsp. *scirpoidea.*

Carex scabriuscula Mackenzie, Bull. Torrey Bot. Club 35: 268. 1908. TYPE: U.S.A. Wet meadow in the Cascade Mountains, 30 June 1902, *Cusick # 2849.* (holotype, NY; isotypes, CU, DS, ORE, OSC, POM, UC, WS).

Carex gigas (Holm) Mackenzie, Bull. Torrey Bot Club 35: 268. 1908. Syn. nov. *Carex scirpoidea* var. *gigas* Holm, Amer. J. Sci. IV 18: 20. 1904.

Historically, *Carex scabriuscula* and *Carex gigas* have been treated as two separate serpentine endemics in Oregon and California, respectively. Evidence from their morphology, chromosome number, leaf anatomy, and achene micromorphology (Dunlop, 1990) suggests that these serpentine taxa are synonymous. Since both taxa were simultaneously described at the rank of species (Mackenzie, 1908), I have chosen to use the name *C. scabriuscula* because the type specimen is known despite the vague locality data. When Mackenzie (1908) described this species he designated a type specimen collected by William Cusick, which was initially distributed as *Carex feta.* I did not chose the name *C. gigas* because when Holm (1904) described *C. gigas* as a variety of *C. scirpoidea,* he did not designate a type specimen. He merely indicated that the taxon occurred on Mt. Eddy, Siskiyou County, California. In 1908 when Mackenzie raised this taxon to the specific level, he did not lectotypify this species but only referred to Cyrus Pringle's specimen from 8000 feet, Siskiyou County, California, 18 August 1881. It is not known at this time which specimen of Pringle's was examined by Holm in 1904.

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New Species of *Aristea* Section *Racemosae* (Iridaceae) from the Cape Flora, South Africa

Peter Goldblatt

B. A. Krukoff Curator of African Botany, Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166, U.S.A.

John C. Manning

National Botanical Institute, P. Bag X7, Claremont 7735, South Africa

ABSTRACT. *Aristea fimbriata*, *A. inaequalis*, and *A. rupicola* are new to this genus of some 52 species of sub-Saharan Africa and Madagascar. The new species all occur in the western part of the southern African winter-rainfall climatic zone and are highly local endemics, two of them known only from single extended populations. All three species have three-winged capsules, a specialized condition that defines subgenus *Aristea*, a taxon virtually restricted to the southern African winter-rainfall zone. In addition the new species have pollen grains with apertures confined to one face of the grain, either monosulcate or trichotomosulcate, and have specialized, undivided styles that define section *Racemosae*, one of two sections of subgenus *Aristea*. Observations on the pollination biology of *A. inaequalis* show that it is probably pollinated by female *Anthophora diversipes* (Anthophoridae) bees, which forage for pollen on the flowers of this species. This pollination strategy conforms to that of other blue-flowered species of the genus, that is, they have flowers adapted for pollination by various species of female bees foraging for pollen. A revised key to section *Racemosae* is presented, which includes entries for apparently undescribed taxa that require further investigation.

Section *Racemosae* is one of two sections of the exclusively southern African subgenus *Aristea* of the sub-Saharan African and Malagasy genus *Aristea*, which comprises some 52 species (Weimarck, 1940; Goldblatt & Manning, 1997; Goldblatt & Le Thomas, 1997). Both section *Aristea*, with 6 species, and section *Racemosae*, with an estimated 14 including the 3 new species described here, are largely restricted to the southern African winter-rainfall zone in the south and west of the subcontinent. They also occur almost exclusively on the nutrient-poor, well-drained, rocky sandstone-derived soils that characterize a large part of the winter-rainfall zone.

Here we describe three new species of section *Racemosae*, all narrow endemics of the western half of the winter-rainfall zone. Two of these, *Aristea fimbriata* and *A. rupicola*, are comparatively recent discoveries, but *A. inaequalis* has been known at least since 1911, when it was collected by E. P. Phillips on the Gifberg in northern Western Cape Province. That species has, however, often been confused in herbaria with *A. monticola* Goldblatt, also called *A. caerulea* Thunberg, an illegitimate superfluous name (Goldblatt & Barnard, 1970). No specimens of *A. inaequalis* were, however, cited under any species of section *Racemosae* by Weimarck (1940) in the only complete, modern account of *Aristea*, a treatment now seriously out-of-date.

All three new species described here have the plesiomorphic pollen grains with a single aperture confined to one surface of the grain and derived, undivided style branches that characterize section *Racemosae* (Goldblatt & Le Thomas, 1997), as well as broadly winged capsules with two to four radially compressed seeds per locule that define subgenus *Aristea*. *Aristea fimbriata* is distinctive in its low stature, inflorescence with the spathes and bracts fringed and brown-tipped, and, moreover, stands out palynologically in the section in having pollen grains with a trichotomosulcate aperture (Le Thomas et al., 1996; Goldblatt & Le Thomas, 1997). Other species of the section have pollen grains with a conventional elliptic aperture except for one evidently aberrant population of *A. zeyheri* Baker, which has zonasulculate grains. Plants from other populations have typical monosulcate pollen grains (Goldblatt & Manning, 1997). *Aristea inaequalis* and *A. rupicola* are lithophytes and only grow in rock crevices in sandstone outcrops, a habitat that is unusual in the genus.

1. Aristea inaequalis Goldblatt & J. C. Manning, sp. nov. TYPE: South Africa. Western Cape: rocky sandstone plateau at the top of Gifberg, 3 Oct. 1996, *Goldblatt & Manning 10561* (holotype, NBG; isotypes, K, MO). Figures 1, 2.

Plantae ca. 100–150 cm altae caespitosae, foliis disti-

Figures 1–4. —1. *Aristea inaequalis*, growing on sandstone pavement on the Gifberg Plateau, Western Cape Province, South Africa. —2. Close-up of inflorescence of *A. inaequalis*. —3. Tuft of *Aristea fimbriata* at the type locality, Piketberg Mountains, Western Cape Province, South Africa. —4. Type collection of *Aristea rupicola*.

chis lineari-ensiformibus glaucis marginibus rubro-translucentibus, caulibus 3–5 usitate rubris ad quemque nodum ramum longum unum et saepe ramos 1–2 breves ferentibus, inflorescentiis rhipidiis binatis quoque 1–2 florum lateralibus sessilibus, spathis membranaceis marginibus late translucentibus 8–10 mm longis, bracteis 6–8 mm longis, floribus atrocaeruleis saepe secundis, tepalis patentibus inaequalibus exterioribus 14–16 × 7–9 mm, interioribus ca. 14–16 × 10–11 mm, filamentis atrocaeruleis inaequalibus superioribus ca. 6 mm longis inferiore ca. 8 mm longo, antheris ca. 3 mm longis flavis, stylo indiviso excentrico, capsulis 3-alatis ca. 8 mm longis.

Plants mostly 100–150 cm high, forming tussocks with age. *Rootstock* a short creeping rhizome, 3–4 mm diam. *Leaves* several, in a tight basal fan, about half as long as the stems, narrowly sword-shaped, 4–5 mm wide, glaucous, the margins hyaline and thin, usually reddish, the upper one or two leaves cauline and shorter than the basal. *Stems* usually 3 to 5 per plant, erect, ± terete, dull red, usually with several branches, straight, with 1 long branch and often 1–2 short ones at each node, the branches 40–100 mm long, inflorescences usually several per branch and sessile or the lowermost very shortly stalked, each branching node subtended by a bract 2–6 cm long, this either green below or entirely reddish brown, the margins and apices dry. *Inflorescences* binate rhipidia forming a compound, open branched pseudopanicle, individual binate rhipidia sessile along the branches, usually 4-flowered, individual rhipidia thus usually 2-, occasionally 1-flowered; *rhipidial spathes* ± lanceolate, the outer or both with an attenuate cusp, dry and brownish with broad translucent, whitish margins, usually 8–10 mm long; *floral bracts* like the spathes but 6–8 mm long, usually slightly shorter than the spathes, irregularly 1- or 3-lobed apically. *Flowers* with pedicels ca. 1 mm long, stellate, usually facing to the side, dark blue, the center yellow-green; *tepals* united basally for ca. 1 mm, patent, the whorls unequal, the outer obliquely lanceolate, obtuse, 14–16 × 7–9 mm, the inner 14–16 × 10–11 mm, obtuse to emarginate. *Filaments* straight and diverging, normally unequal, the upper two ca. 6 mm long, the lower one ca. 8 mm long, dark blue; *anthers* ca. 3 mm long, yellow, the pollen yellow, grains monosulcate. *Ovary* oblong-trigonous, ca. 4 mm long; *style* eccentric, 9–10 mm long, slender and undivided apically, dark blue-black. *Capsules* almost square in outline, 7–8 mm long, with three broad wings. *Seeds* radially compressed, semicircular, ca. 4 × 2.5 mm, the epidermis colliculate.

Flowering time. Mostly September to early November.

Although known since at least 1911, *Aristea inaequalis* has long been confused in herbaria with the superficially similar *A. confusa* Goldblatt and *A. monticola.* Specimens of the species do not appear to have been seen by Weimarck (1940), and no members of section *Racemosae* from the Vanrhynsdorp and Calvinia Districts, where *A. inaequalis* grows, were cited by him in his monograph of the genus. Morphologically *Aristea inaequalis* can be recognized by its long, narrowly sword-shaped leaves with a gray, waxy surface, broad, translucent, reddish margins, and branched stems with a straight main axis. The 3–5 main branches are also fairly straight and spreading and bear several, sessile lateral binate rhipidia. The flowers are more or less typical of the genus but are particularly deep blue, and they typically face to the side. A striking feature of the flowers, at least of the living plants we have examined on the Gifberg, is the unequal stamens. The lower (anterior) filament is held slightly apart from the others and is ca. 2 mm longer than the two upper filaments. The bright yellow anthers are equal in size as they are throughout the genus. The style is typical of section *Racemosae,* being eccentric and undivided, the latter a defining feature of the section.

The relationships of *Aristea inaequalis* within the section are uncertain. The cuspidate floral bracts with broad transparent margins recall those of *A. major* Goldblatt, in particular. This is normally a tall plant with broad, bright green leaves and is the only other species of the section that usually has secund flowers. It is, however, readily distinguished from *A. inaequalis* by the crowded, columnar inflorescence with short lateral branches, as well as the broad leaves. Although *A. monticola* is similar to *A. inaequalis* vegetatively, especially in the narrow leaves with hyaline margins, usually lacking an obvious waxy bloom, it has a sparsely branched stem, the branches are short, and the rhipidia have much larger spathes that are very different in being ovate, obtuse to truncate, becoming somewhat fringed with age, and particularly distinctive in being sparsely hairy on the reverse (Weimarck, 1940; Lewis, 1950a). Both grow in rocky sandstone soils and in fynbos communities, but *A. inaequalis* is rarely found except in crevices in sandstone pavement (Fig. 1), most often close to west-facing mountain escarpments where the rainfall is substantially higher than inland. *Aristea monticola,* in contrast, favors open stony slopes where there is deeper soil, and it behaves as a pyrophyte, flowering well only in seasons following fire. The pollination ecology of *A. inaequalis* appears to closely parallel that of other blue-flowered species of the genus for which this aspect of their biology is known. The flowers are visited by female *Anthophora diversipes* bees (family

Anthophoridae) that actively collect pollen from the anthers. Like nearly all species of the genus, flowers of *A. inaequalis* do not offer nectar as a reward. As the bees forage for pollen, they are liberally dusted with pollen, which is readily transferred to the stigma of another flower as it flies from one plant to another. The pattern of pollination resembles that reported for other species of *Aristea* that have flowers adapted for bee-pollination (Goldblatt & Manning, 1997), but *A. diversipes* has not been reported visiting other *Aristea* species.

Paratypes. SOUTH AFRICA. **Western Cape:** 3118 (Vanrhynsdorp) Gifberg, 18 Sep. 1911, *Phillips 7623* (NBG, PRE), 14 Oct. 1953, *Esterhuysen 22077* (BOL), 9 Oct. 1959, *Werdermann & Oberdieck 525* (K, PRE), 23 Aug. 1984, *Goldblatt 7223* (MO, PRE); Gifberg near the top among large boulders (BB), 17 Sep. 1961, *Barker 9590* (NBG); Nardouw Mts., rock cracks in dry stream bed (BC), 6 Sep. 1951, *Barker 7445* (NBG); 3218 (Clanwilliam) Nardouw Kloof (BB), Sep. 1947, *Stokoe s.n.* (SAM). **Northern Cape:** 3119 (Calvinia) Glen Ridge, Nieuwoudtville (AC), 9 Nov. 1961, *Barker 9639* (NBG); Grasberg road, sandstone rocks, 27 Aug. 1968 (fr), *Goldblatt 271* (BOL); Lokenberg, sandstone rocks, 10 Oct. 1953, *Acocks 17332* (K, PRE), 31 May 1964 (fr), *Esterhuysen 30719a* (BOL); Kobee Mts., farm Kikvorsfontein (CA), 20 Aug. 1992 (early flower), *Rourke 1977* (NBG).

2. Aristea rupicola Goldblatt & J. C. Manning, sp. nov. TYPE: South Africa. Western Cape: track to Heuningvlei, on sandstone outcrops and low cliffs, 19 Dec. 1995, *Goldblatt 10446* (holotype, NBG; isotypes, K, MO, PRE). Figure 4.

Plantae (15–)20–40 cm altae, foliis distichis linearo-ensiformibus glaucescentibus marginibus rubro-translucentibus, caulibus dichotome ramosis rubris, inflorescentiis rhipidiis binatis quoque 5–6 florum, spathis membranaceis ca. 6 mm longis leviter pubescentibus, bracteis 7–8 mm longis, floribus atrocaeruleis 20–28 mm in diametro, tepalis patentibus subaequalibus 8–14 × 5–9 mm, exterioribus aliquot minoribus quam interioribus, filamentis inferne flavis superne atrocaeruleis ca. 4 mm longis, antheris ca. 3 mm longis flavis, stylo indiviso excentrico, capsulis 3-alatis ca. 7 mm longis.

Plants (15–)20–40 cm high. *Rootstock* a short creeping rhizome, ca. 3 mm diam. *Leaves* several, in a tight basal fan, reaching at least to the base of the branches, sometimes shortly exceeding the stem, linear, 3–4 mm wide, somewhat thicker toward the middle, the margins narrowly hyaline and thinner than the green part, the upper one or two leaves cauline and shorter than the basal, the uppermost leaf often partly or entirely dry. *Stems* 1 to 4 per plant, erect or inclined, compressed and elliptic in transverse section below, ± terete above the first branch, usually with several branches and flexuose, 1-, 2- or 3-branched at each node, occasionally with a second order of branching, the branches 15–25 mm long, each branching node bearing a dry bract 2–4 cm long, folded in the midline. *Inflorescences* binate rhipidia, together forming a compound pseudopanicle, each binate rhipidium terminal on a branch, the lower branches usually each with a short lateral branch, the upper branches simple, occasionally 2-, usually 5- to 6-flowered, individual rhipidia thus 1–3-flowered, the flowers crowded; *rhipidial spathes* ± ovate, dry and rust-colored, the margins membranous and translucent with fine brown flecks, truncate to emarginate, usually sparsely hairy, 6–7 mm long; *floral bracts* membranous to scarious, solid in the center otherwise membranous and translucent, minutely flecked and streaked with brown above, sparsely and minutely hairy, 7–8 mm long, irregularly truncate and obscurely 3–4-lobed. *Flowers* with pedicels ca. 1 mm long, stellate, light blue, pale yellow edged with violet in the center, the tepal midlines also violet; *tepals* united basally for ca. 1 mm, obovoid, obtuse to emarginate, patent, 8–14 × 5–9 mm, the inner slightly larger than the outer. *Filaments* straight and slightly diverging, ca. 4 mm long, pale yellow in the lower third, dark blue above; *anthers* ca. 3 mm long, pale yellow, the pollen pale yellow, grains monosulcate. *Ovary* oblong-trigonous, ca. 3.5 mm long; *style* eccentric, ca. 6 mm long, slender and undivided apically, pale greenish below, darkening to blue in the upper third. *Capsules* ovoid in outline, broadly three-angled to three-winged, ca. 7 mm long. *Seeds* unknown.

Flowering time. November to mid December.

A highly localized species, *Aristea rupicola* has been recorded only from the northern Cedarberg Mountains in Western Cape Province, South Africa. The known populations are all from a short distance south of Pakhuis Pass, near Clanwilliam. Available records indicate that *A. rupicola* was first collected by the South African botanist M. A. Pocock, in 1923, and since then only three times, most notably by the botanist H. C. Taylor, in 1987. These collections were initially confused with the widespread *A. dichotoma* (Thunberg) Ker Gawler of section *Aristea* and thus did not at first raise any interest. The resemblance is entirely superficial, and the two species belong in separate sections of the genus. *Aristea rupicola* grows exclusively in small pockets of soil, or sometimes in rock crevices without any soil in sandstone outcrops and low cliffs. There they are most common on the cooler and somewhat damper south and southeast trending slopes. In this extremely xeric habitat plants flower in November until mid December, months after the last substan-

tial rainfall in this area of fairly low, exclusively winter precipitation.

The relationships of *Aristea rupicola* evidently lie with *Aristea* sect. *Racemosae*, and it has the 3-winged capsules and virtually undivided style characteristic of the section. Its apparently somewhat angular, rather than completely flattened, seeds are discordant in section *Racemosae*, but *A. rupicola* has the monosulcate pollen grains characteristic of the section. Monosulcate pollen grains are most likely the ancestral condition in *Aristea*; although they are uncommon in the genus, they are present in nearly all species of section *Racemosae* as well as *A. singularis* Weimarck (sect. *Aristea*) and *A. schizolaena* Baker, a member of the tropical and eastern southern African section *Eucapsulares* (sect. *Euaristea* Weimarck), the other members of which have zonasulculate or dizonasulculate pollen grains. The broadly trigonous capsules of *A. rupicola* are quite unlike the ovoid capsules that characterize section *Eucapsulares*.

Aristea rupicola has the general aspect of the narrow-leaved *A. inaequalis*, described above, although it is a much smaller plant. It is, however, readily distinguished from that species by its divaricately branched stem with all the binate rhipidia stalked. The capsules are similar in shape to those of *A. inaequalis* and to several other species of the section, including *A. major* and *A. monticola*, being broadly winged and more or less square in outline, but the locules are less narrowly winged than either of its apparent relatives. More significantly, the rhipidial spathes and bracts of *A. rupicola* differ markedly from those of *A. inaequalis*. The spathes are 6–8 mm long, ovate, and rusty brown with broad, dry, translucent edges finely flecked with brown. The slightly larger floral bracts are largely translucent and dry with brown apices and also have fine brown flecks in the upper half. Both the spathes and floral bracts are more or less obtuse and sparsely hairy, particularly on the inner surfaces. In contrast, the spathes of *A. inaequalis* are 8–10 mm long, lanceolate with attenuate cusps, smooth, and have broad whitish margins without dark spots, and the floral bracts are 6–8 mm long, thus slightly shorter to about as long as the spathes, which they resemble in texture and coloring.

The spathes and floral bracts of *Aristea rupicola* recall those of two other members of section *Racemosae*, *A. macrocarpa* G. J. Lewis and *A. monticola*, both in their more or less ovate shape, rust-brown coloring, and sparse vestiture (Lewis, 1950a, b). The bract similarities appear to constitute the most compelling evidence for relationships within section *Racemosae*, and we assume that these three species with hairy bracts constitute a clade. On the basis of overall size and leaf width *A. rupicola* appears most closely related to *A. monticola*, of which it may be a geographic segregate.

Paratypes. SOUTH AFRICA. **Western Cape:** 3219 (Wuppertal) Cedarberg, Heuningvlei, sandy vlakte, 24 Oct. 1923, *Pocock 622* (NBG); Groenberg, jeep track to Heuningvlei (AA), 6 Nov. 1987, *Taylor 11889* (NBG); between Wuppertal and Eselbank, rock crevices (AC), 27 Oct. 1977, *Emdon 162* (NBG).

3. **Aristea fimbriata** Goldblatt & J. C. Manning, sp. nov. TYPE: South Africa. Western Cape: Piketberg Mountains, high plateau S of Zebrakop, 6 Jan. 1995, *Goldblatt & Manning 10167* (holotype, NBG; isotypes, E, K, MO, PRE, WAG). Figures 3, 5.

Plantae 22–30 cm altae, foliis falcatis ca. 4 mm latis, caulibus erectis complanatis inferne ca. 3 mm latis pauciramosis, inflorescentiis rhipidiis binatis ad 8 florum, spathis rhipidii praeter medianum viridibus scariosis translucentibus plerumque marginibus superioribus fimbriatis ferrugineis, bracteis floralibus omnino scariosis translucentibus, marginibus superioribus fimbriatis ferrugineis, floribus caeruleis pedicelis 2–3 mm longis, tepalis infime ca. 1.5 mm connatis late obovoideis patentibus, exterioribus ca. 14 × 6 mm, interioribus ca. 14 × 7.5 mm, filamentis ca. 5 mm longis adscendentibus, antheris flavis ca. 3 mm longis, stylo indiviso excentrico, capsulis late 3-alatis ad 15 mm longis.

Plants 22–30 cm high, forming dense, many-stemmed tufts 15–25 cm diam. *Rootstock* a short creeping rhizome ca. 3 mm diam. *Leaves* 7–9 per stem, mostly basal but at least 2 cauline and inserted on the upper half of the stem, the blades plane, falcate, the largest 3–4 mm wide, slightly shorter than the stems, the cauline leaves shorter than the basal. *Stems* erect, usually 2–3-branched, the branches somewhat crowded apically and short, usually 10–15 mm long, compressed and narrowly 2-winged below, 2-angled above, bracts subtending the branches 20–35 mm long, thus exceeding the branch, green, the margins transparent, folded in the midline and keeled above. *Inflorescences* binate rhipidia, together forming a pseudoraceme, individual binate rhipidia with up to 8 flowers, thus individual rhipidia usually 2- to 4-flowered; *rhipidial spathes* 11–14 mm long, green and firm-textured in a narrow band along the midline, elsewhere scarious and translucent, the upper margins fimbriate and rust-colored; *floral bracts* entirely scarious, translucent, the margins fimbriate and rust-colored, 11–14 mm long. *Flowers* borne on pedicels 2–3 mm long, actinomorphic, deep blue; *tepals* connate below for ca. 1.5 mm, obovate, the outer tepals somewhat smaller than the inner, ca. 14 × 6 mm, the

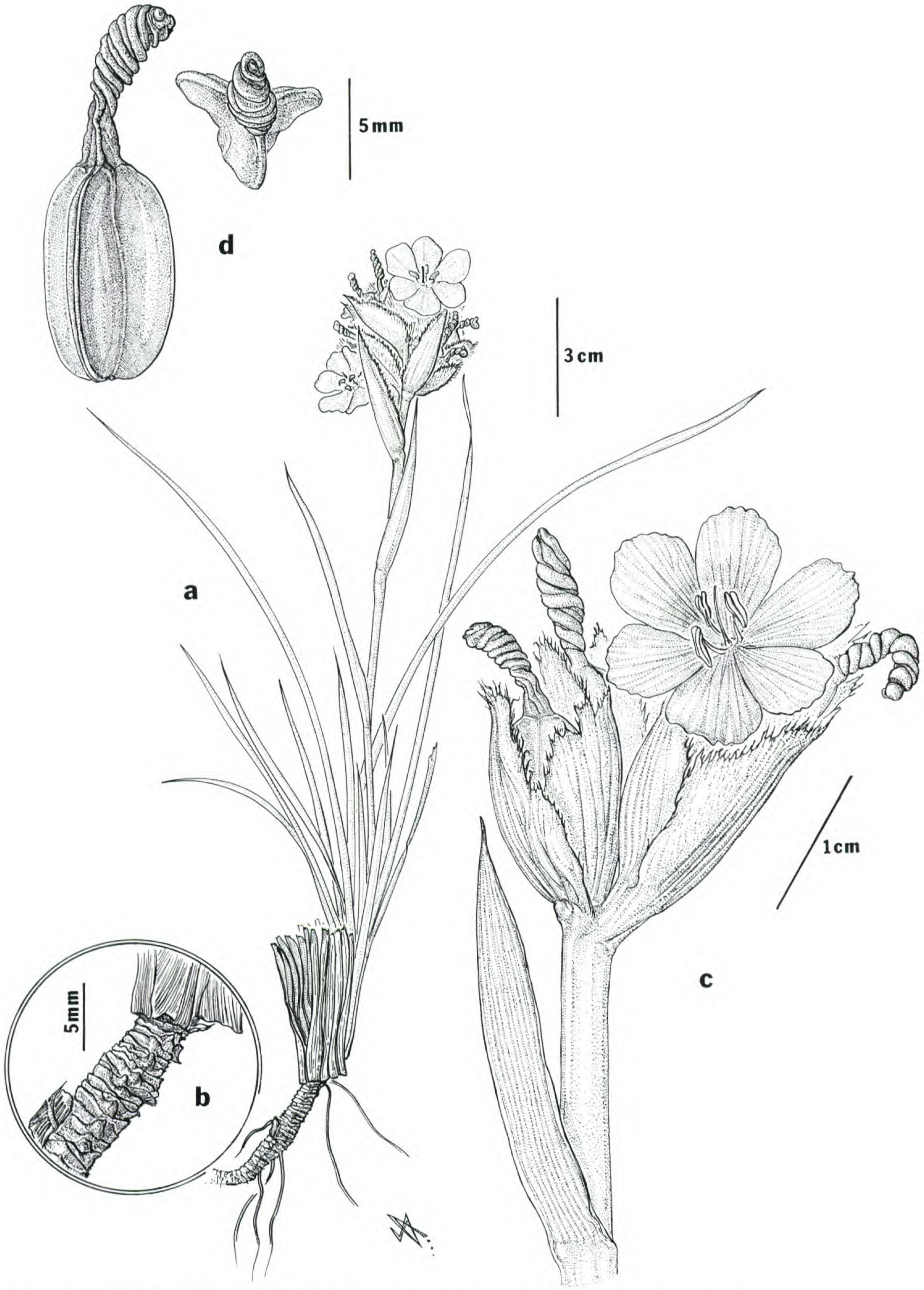

Figure 5. *Aristea fimbriata*, drawn from the type collection. —a. Whole plant. —b. Detail of rhizome. —c. Apex of flowering stem showing binate rhipidium with fringed rhipidial spathes and floral bracts. —d. Side and top view of young capsules. (Drawn by John Myers.)

inner tepals broadly obovate, ca. 14 × 7.5 mm. *Filaments* ascending, adnate to the tepal bases, ca. 5 mm long; *anthers* ca. 3 mm long, yellow, the pollen yellow. *Ovary* narrowly obovoid in outline, obscurely three-winged at anthesis, 4–5 mm long; *style* filiform, eccentric, tapering slightly above, ca. 8 mm long, the stigma minutely forked apically. *Capsules* oblong in profile, with 3 broad, thin wings, evidently ca. 15 mm long; *seeds* radially compressed, evidently up to four per locule (mature capsules and seeds not known).

Flowering time. December to mid January, the flowers opening early in the morning and fading in the early afternoon.

Known only from the higher parts of the Piketberg Mountains in Western Cape Province, South Africa, *Aristea fimbriata* was not discovered until 1995. The type collection, from the plateau south of Zebrakop and north of the farm Bugler's Post, was made in early January, a year after a fire had burnt a large part of the Piketberg. *Aristea fimbriata* has the broadly 3-winged capsules and undivided style typical of section *Racemosae* and evidently belongs in this section despite its unusually low stature and compressed, 2-angled stem not present in any other species of the section. Like the other species of section *Racemosae* it grows in rocky sandstone habitats and flowers best after fires. This and its apparently highly restricted distribution perhaps explain why it has remained unknown for so long. When discovered on a hot summer morning the tufted plants were in full bloom, the dark blue flowers making a fine display in the rocky terrain. Later that day, when we were returning after a hike through the mountains to the north, the plants were barely noticeable for the flowers had faded and deliquesced, and were coiled spirally on top of the ovaries. Both the early morning flowering, the fading in the early afternoon, and the spiral twisting of faded flowers are characteristic, although not universal, attributes of *Aristea*.

Within section *Racemosae*, *Aristea fimbriata* may be most closely allied to *A. juncifolia* Baker and *A. racemosa* G. J. Lewis. These two species are also relatively small plants, and they have strongly winged, rather elongate capsules almost exactly like those of *A. fimbriata*. *Aristea juncifolia* also has large bracts subtending the binate rhipidia, which are keeled above and often folded along the lower midline, fairly similar to those of *A. fimbriata*. Most other species of the section are taller, more robust plants with broader leaves and have taller, more branched stems. The most striking features of *A. fimbriata*, and the one for which it is named, are the scarious, translucent rhipidial spathes and floral bracts, which have the margins deeply fimbriate and rust-colored (Fig. 5). Other members of the section have transparent or rust-colored bracts that are initially entire or regularly cuspidate, sometimes later becoming irregularly torn. The leaves of *A. fimbriata* are also distinctive in being falcate, plane, and relatively soft-textured, rather different from the strongly fibrotic leaves of most members of section *Racemosae*.

The characteristic fimbriate and rust-colored spathes and bracts of *Aristea fimbriata* recall those of *A. africana* (L.) Hoffmannsegg and *A. recisa* Weimarck (sect. *Aristea*—Goldblatt, 1991; Goldblatt & Le Thomas, 1997) and *A. woodii* Baker (sect. *Eucapsulares*). Specialized seed and pollen features of these last species leave no doubt that they are correctly placed according to the current classification of the genus (Goldblatt & Le Thomas, 1997). Thus the fimbriate spathes and bracts of *A. fimbriata* must be interpreted as a convergent development. The pollen grains of *A. fimbriata* are unusual for *Aristea* in having a trichotomosulcate aperture. The sulcus is, however, confined to one face of the pollen grain, unlike the derived trisulcate or more or less spiraperturate grains of section *Africana* or the sulculate grains of most species of section *Eucapsulares* (Goldblatt & Le Thomas, 1992, 1997), and to this extent are consistent with the grains of section *Racemosae*.

Paratypes. Known only from the type.

Key to *Aristea* Sect. *Racemosae*

Capsules with three narrow vertical wing-like lobes containing 2–4 laterally compressed seeds (also sect. *Aristea*); styles undivided or minutely trifid apically; pollen grains with a single, usually elliptic sulcus (plesiomorphic in the genus), rarely the grains trichotomosulcate characterize section *Racemosae*. The key includes reference to *A. sp.* = *A. racemosa* var. *inflata* Weimarck, which we believe may be a separate species, and *A. zeyheri*, transferred here from section *Pseudaristea* (Goldblatt & Manning, 1997). We tentatively include *A. bakeri* Klatt and *A. confusa* in the key but seriously doubt that they are separable. The key characters are taken directly from Weimarck (1940), but we doubt their utility.

Note. The robust and very distinct *Aristea latifolia* G. J. Lewis (1952) from the Dutoit's Kloof–Wemmershoek–Hottentot's Holland Mountain complex has short capsules, 8–10 mm long, deeply lobed between the locules, but the locules themselves are rounded and contain angular, prismatic seeds. Despite an ap-

parently undivided style (we have not seen living plants), the species does not, on the basis of capsules and seeds, appear to belong in section *Racemosae*. The pollen grains are, however, monosulcate (Goldblatt, unpublished observation) like those of nearly all members of the section. *Aristea latifolia*, only described in 1952, was not included in Weimarck's monograph of the genus, published in 1940. We suggest that *A. latifolia* be provisionally included in subgenus *Aristea* sensu Goldblatt & Le Thomas (1997) in a section of its own, section *Latifolia*, until we know more about its relationships.

1. Leaves terete to elliptic in transverse section and 1–3 mm wide; capsules oblong in outline, at least twice as long as wide.
   2. Leaves elliptic (sometimes almost plane) in transverse section, usually 2–3 mm diam., occasionally less; binate rhipidia each subtended by a prominent green bract, this keeled above, and often folded in the midline below, and at least the lower exceeding the spathes and floral bracts . . . . . *A. juncifolia* Baker
   2′. Leaves terete to elliptic and less than 2 mm at the widest; binate rhipidia either not subtended by a prominent bract, or if bract present, usually dry and not keeled above but lightly folded in the midline below.
      3. Plants robust, often growing in dense clumps and 30–60 cm high; lower binate rhipidia subtended by large, evidently dry bracts . . . . . *A. sp.* = *A. racemosa* var. *inflata* Weimarck
      3′. Plants fairly short and fairly slender, not growing in clumps and up to 30 cm high; lower binate rhipidia not subtended by prominent dry bracts.
         4. Flower clusters (1–)3–8, the lateral all (or mostly) sessile; spathes and floral bracts ferruginous with narrow to broad transparent margins, 10–15 mm long; capsules mostly 10–14 mm long . . . . . *A. racemosa* Baker
         4′. Flower clusters usually 1, occasionally 2, the lateral sessile; spathes and floral bracts green, drying blackish, with narrow transparent margins, 15–24 mm long; capsules 18–25(–30) mm long . . . . . *A. zeyheri* Baker
1′. Leaves ± plane or slightly elliptic in section, the larger basal leaves at least 3 mm wide, usually 4–12 mm wide; capsules broadly ovate to oblong, about as long to more than twice as long as wide.
   5. Spathes and floral bracts broadly ovate/obovate and lightly hispidulous.
      6. Plants small, up to 20–40 cm high; lower leaves 2–3 mm wide; flowering stems dichotomously branched and all binate rhipidia stalked . . . . . *A. rupicola* Goldblatt & J. C. Manning
      6′. Plants taller, (50–)80–150 cm high; lower leaves (3–)4–12 mm wide; flowering stems pseudoracemosely branched and binate rhipidia at the upper stem usually sessile.
         7. Lower leaves (8–)12–25 mm wide; capsules 20–30 mm long . . . . . *A. macrocarpa* G. J. Lewis
         7′. Lower leaves (3–)4–6 mm wide; capsules 7–10 mm long . . . . . *A. monticola* Goldblatt
   5′. Spathes and floral bracts either lanceolate and acute to acuminate or ovate but always smooth.
      8. Spathes and floral bracts lanceolate and acuminate, dark green to brown in the center with wide transparent margins; capsules 8–12 mm long, slightly longer to almost twice as long as wide; flowers mostly secund.
         9. Inflorescence a congested cylindric compound panicle, the flower clusters overlapping and largely or completely concealing the main axis; stamens equal . . . . . *A. major* Andrews
         9′. Inflorescence a lax panicle the lower branches long and diverging, the flower clusters widely spaced along the branches; stamens unequal, the lower (anterior) filament ca. 2 mm longer than the upper two . . . . . *A. inaequalis* Goldblatt & J. C. Manning
      8′. Spathes and floral bracts lanceolate and acute to ovate; capsules 14–20 mm long, at least twice to about three times as long as wide; flower not normally secund, usually upright.
         10. Leaves 8–20 mm wide—the following two species were distinguished by Weimarck as follows, but we cannot separate material assigned to them and wonder if they are not conspecific.
            11. Bracts brown and persisting; branches of the inflorescence erect; seeds dark, 3–4(–5) mm long . . . . . *A. confusa* Goldblatt (= *A. capitata* sensu Weimarck)
            11′. Bracts gray-green and caducous; branches of the inflorescence spreading; seed brown, 1.5–2 mm long . . . . . *A. bakeri* Klatt
         10′. Leaves 3–6 mm wide.
            12. Spathe and floral bract margins fringed and the margins rust-brown; stems compressed and 2-winged; plants small, seldom exceeding 28 cm . . . . *A. fimbriata* Goldblatt & J. C. Manning
            12′. Spathe and floral bract margins entire or irregularly lacerate (usually so with age); stems ± terete to lightly compressed; plants large, usually exceeding 60 cm.
               13. Plants robust, usually 80–130 cm high; capsules (20–)25–33 mm long; bracts subtending the flower clusters and branches of the synflorescence narrowly lanceolate, not attenuate-cuspidate; leaves 3–5 mm wide, narrowly elliptic in section, and without hyaline margins; flowers with tepals 20–25 mm long; (plants of marshes, flowering only after fire, Cape Point to Hermanus) . . . . . *A. rigidifolia* G. J. Lewis
               13′. Plants mostly 35–60 cm high; capsules 15–20 mm long; bracts subtending the flower clusters and branches of the synflorescence usually long attenuate-cuspidate; leaves plane or lightly channeled, hyaline margins present; flowers with tepals 12–15 mm long; (plants of open sandstone slopes and flats, also flowering only after fire, Cedarberg and Swartberg to Peninsula and Swellendam) . . . . . *A. cuspidata* Schinz

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Validation of *Paulownia catalpifolia* (Scrophulariaceae)

HONG De-yuan
Laboratory of Systematic and Evolutionary Botany, Institute of Botany,
Chinese Academy of Sciences, Beijing 100093, People's Republic of China

ABSTRACT. *Paulownia catalpifolia*, previously invalidly described, is validated.

Paulownia catalpifolia, which is native to Shandong Province (China), was described by Gong (1976). However, the name is invalid, because the original protologue designated two "types," representing flowering and fruiting states. In order to include the species in the forthcoming treatment of the Scrophulariaceae for the *Flora of China*, the name is validated below.

Paulownia catalpifolia T. Gong ex D. Y. Hong, sp. nov. TYPE: China. Beijing, Zizhimen (cultivated), 8 May 1973, *Z. H. Chu 7* (holotype, CAF).

Species *P. fortunei* et *P. elongatae* affinis; ab illa corollis prope basin abrupte curvatis ventre a basi ad faucem longitudinaliter 2-plicatibus, capsulis multo minoribus, 4.5–5.5 cm longis differt; ab hac foliis pendulis longe ovato-cordatis atroviridibus, corollae tubo tenuiore, capsulis oblongo-ellipsoideis (non ovoideis) prope medianum latissimis recedit.

Trees; crown large and high. Trunk straight. Leaves often narrowly ovate-cordate, ca. 2× as long as wide, abaxially densely stellate tomentose, adaxially glabrous, margin entire or undulate and angled, apex acuminate. Thyrses pyramidal or narrowly conical, usually less than 35 cm; cyme peduncle nearly as long as pedicels. Calyx shallowly campanulate, less than 2 cm, glabrescent after flowering; lobes $\frac{1}{3}$–$\frac{2}{5}$ of calyx length, triangular to ovate. Corolla light purple, narrowly tubular-funnelform, 7–8 cm, less than 3.5 cm wide, ridged ventrally, inside with dense small purple spots, base curved forward; throat ca. 1.5 cm, apically less than 3.5 cm diam. Capsule ellipsoid, 4.5–5.5 cm, stellate hairy when young; pericarp to 3 mm.

Paratype. CHINA. Beijing, Zizhimen (cultivated), October 1974, *Z. H. Chu s.n.* (CAF).

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Studies in the Capparaceae XIX: *Cleome torticarpa* n. sp., a Venezuelan Endemic

Hugh H. Iltis
Department of Botany, University of Wisconsin, Madison, Wisconsin, 53706-1381, U.S.A.
(To whom requests for reprints should be sent.)

Thirza Ruiz Zapata
Instituto de Botánica Agrícola, Facultad de Agronomía, Universidad Central de Venezuela, Maracay 2101, Venezuela

ABSTRACT. We describe *Cleome* (sect. *Tarenaya*) *torticarpa* H. H. Iltis & T. Ruiz Zapata n. sp., a distinct, very local endemic annual, known only from wet gallery forests along a perpetually flowing river that exits the mouth of a cave in the Cueva de la Quebrada El Toro National Park, Estado Falcón, Venezuela. It is distinguished from *C. latifolia* Vahl by flattened and then twisted short fruits with more or less explosive dehiscence, and from *C. parviflora* HBK, in addition, by the always 3-foliolate leaves.

RESUMEN. Se describe *Cleome* (sect. *Tarenaya*) *torticarpa* H. H. Iltis & T. Ruiz Zapata n. sp., una especie endémica muy localizada, conocida solamente del Parque Nacional Cueva de la Quebrada El Toro en el Estado Falcón, Venezuela, donde crece en un ambiente permanentemente húmedo. Se distingue de *C. latifolia* Vahl por sus frutos aplanados, torcidos y con una dehiscencia más o menos explosiva, y además de *C. parviflora* HBK, por sus hojas siempre 3-folioladas.

Recent fieldwork in Estado de Falcón, Venezuela (Ruiz Zapata, 1985), brought to light a very local and essentially unarmed *Cleome* of the spiny section *Tarenaya* (Marcgraf ex Rafinesque) Iltis ex Jacobs, a distinctive undescribed species characterized by flattened, twisted siliques, hence to be called:

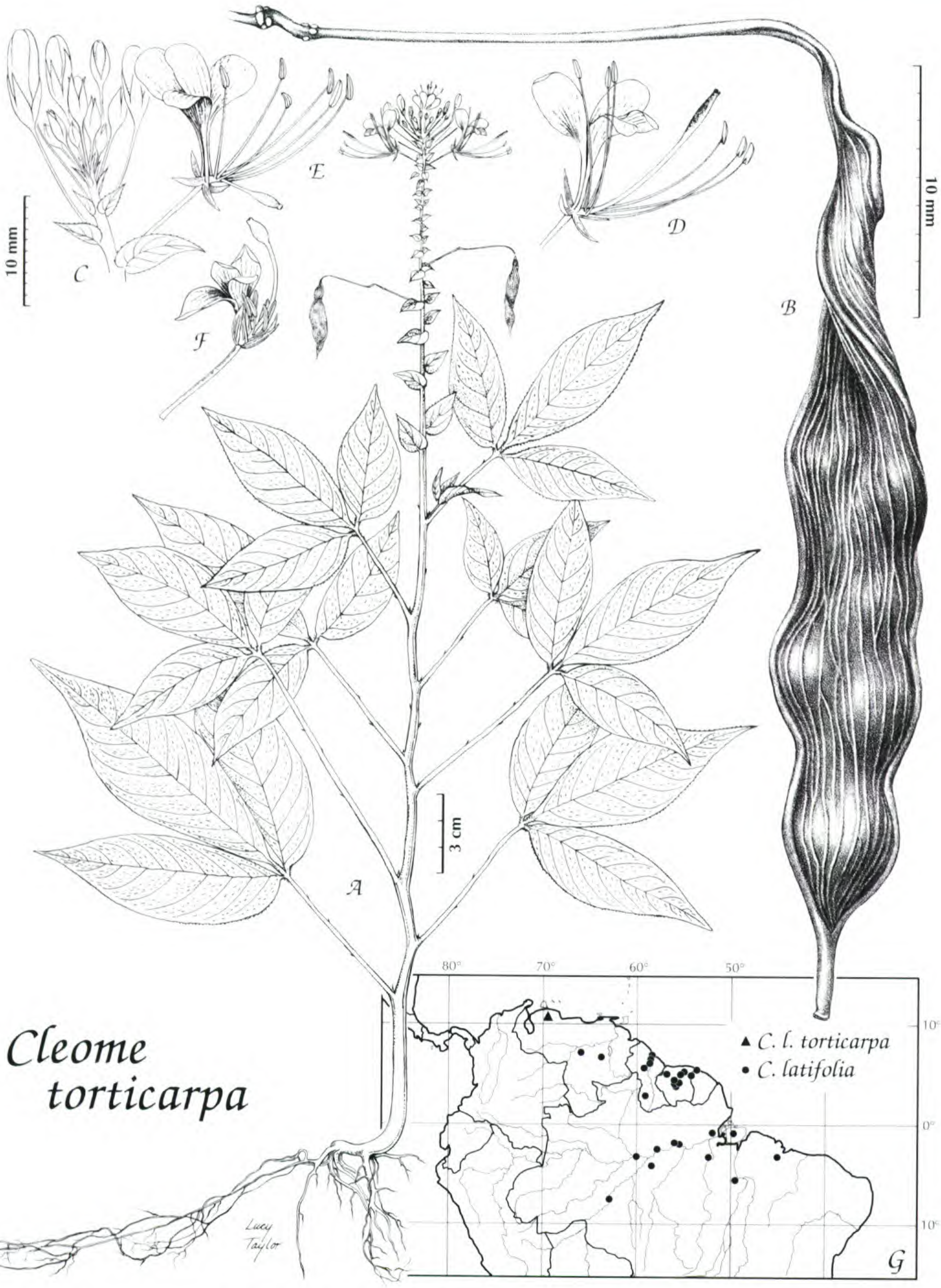
Cleome torticarpa H. H. Iltis & T. Ruiz Zapata, sp. nov. TYPE: Venezuela. Estado Falcón: Distrito Federación, Parque Nacional Cueva de la Quebrada El Toro, 10°50′N, 69°07′W, en selva de galería, bajo sombra, 200 m abajo de la "toma de agua" en la estación del Parque, 600 m, 29 Oct. 1983 (fl y fr), *Thirza Ruiz Zapata & Teo Ruiz 4138* (holotype, MY; isotypes, COL, F, K, MER, MO, NY, US, VEN, WIS). Figures 1, 2.

A *Cleome latifolia* Vahl siliquis planis, sed tortuosis et brevioribus differt, sed foliis 3-foliolatis similis, et a *C. parviflora* HBK siliquis planis, sed tortuosis et foliis semper 3-foliolatis differt.

Slender, unbranched or few-branched, subglabrous, mesophytic, herbaceous *annual*, 15–50 cm tall, with delicate superficial fibrous roots, the erect smooth stems 3–5 mm diam., often basally decumbent-ascending and rooting at the lower nodes, usually lacking "stipular" spines or with a pair of very short (< 1 mm) spines at base of petioles, with many short zig-zag internodes (6–12 per 10 cm), hence (especially near the base) the leaves often crowded.

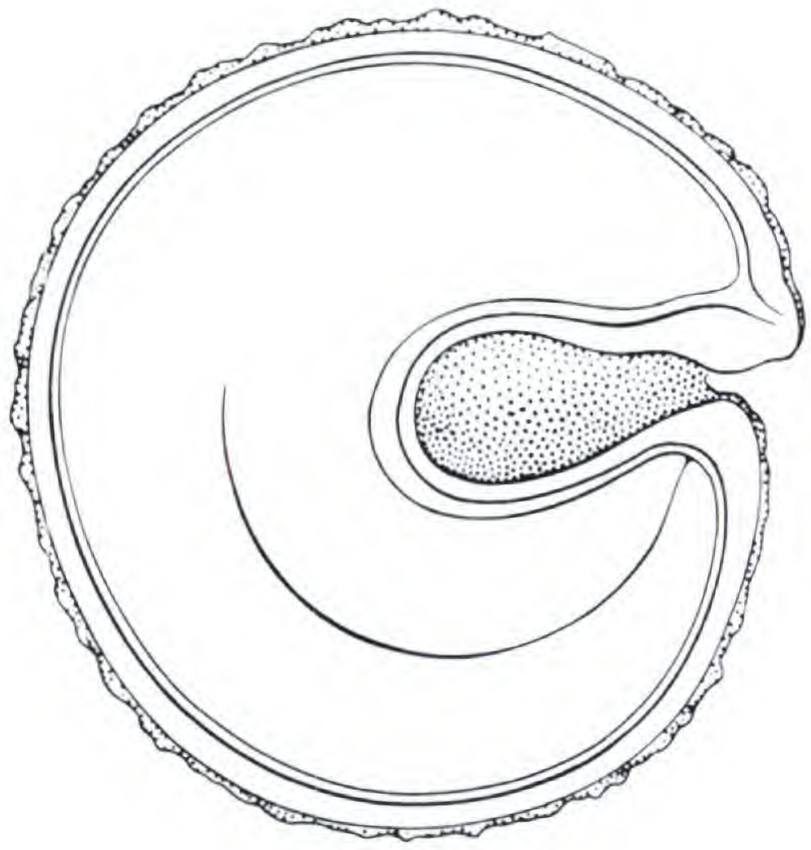
Leaves relatively large, thin, and long-petioled; leaflets 3, the larger 9 × 3 cm to 16 × 5 cm, acuminate to caudate-acuminate at the apex, the central leaflet oblanceolate-elliptic and cuneate at the base, the lateral leaflets lanceolate and strongly asymmetric, with the outer half of the blade broadly rounded or even subcordate at the base, the inner half narrowly attenuate to the petiolule; leaf blades thin, very sparsely pilose with distantly scattered, pustulate, eglandular hairs on both sides, entire, but with short, sharply ascending, eglandular marginal hairs, 10–17 per cm; lateral veins 6–9 on each side, strongly ascending; *petiolules* sometimes quite prominent (4–14 mm long in the central leaflet, shorter in the laterals), these near the base and on the adjoining end of the petiole ± densely minutely puberulent on the upper side; *petioles* of the major leaves 7–12 cm long, rarely [but significantly] with a few scattered, 1–2 mm long, divergent or ascending straight *prickles* on their underside.

Racemes many-flowered, 3–33 cm long, the axis with age often greatly elongating and very slender, ± densely bracteate, the up-to-60 bracts unifoliolate, the lowest ones cordate-ovate to suborbicular and abruptly acuminate, relatively large (8 × 8 to 27 × 19 mm), the upper often greatly reduced in



Cleome torticarpa

Figure 1. *Cleome torticarpa* H. H. Iltis & T. Ruiz Zapata. —A. Whole plant, showing shallow root system (*Flora Falcón 404*). —B. Fruit. —C. Flower buds (B, C, *Ruiz Zapata 4138*). —D. Hermaphrodite (perfect) flower. —E. "Male" flower. —F. "Female" flower (all from cultivated plants, ex Ruiz Zapata 1985, 1990). (A–C, drawing by Lucy Taylor, D, E, by Aristides Mata). —G. Total distribution of *Cleome torticarpa* (triangle) and *C. latifolia* (solid dots).



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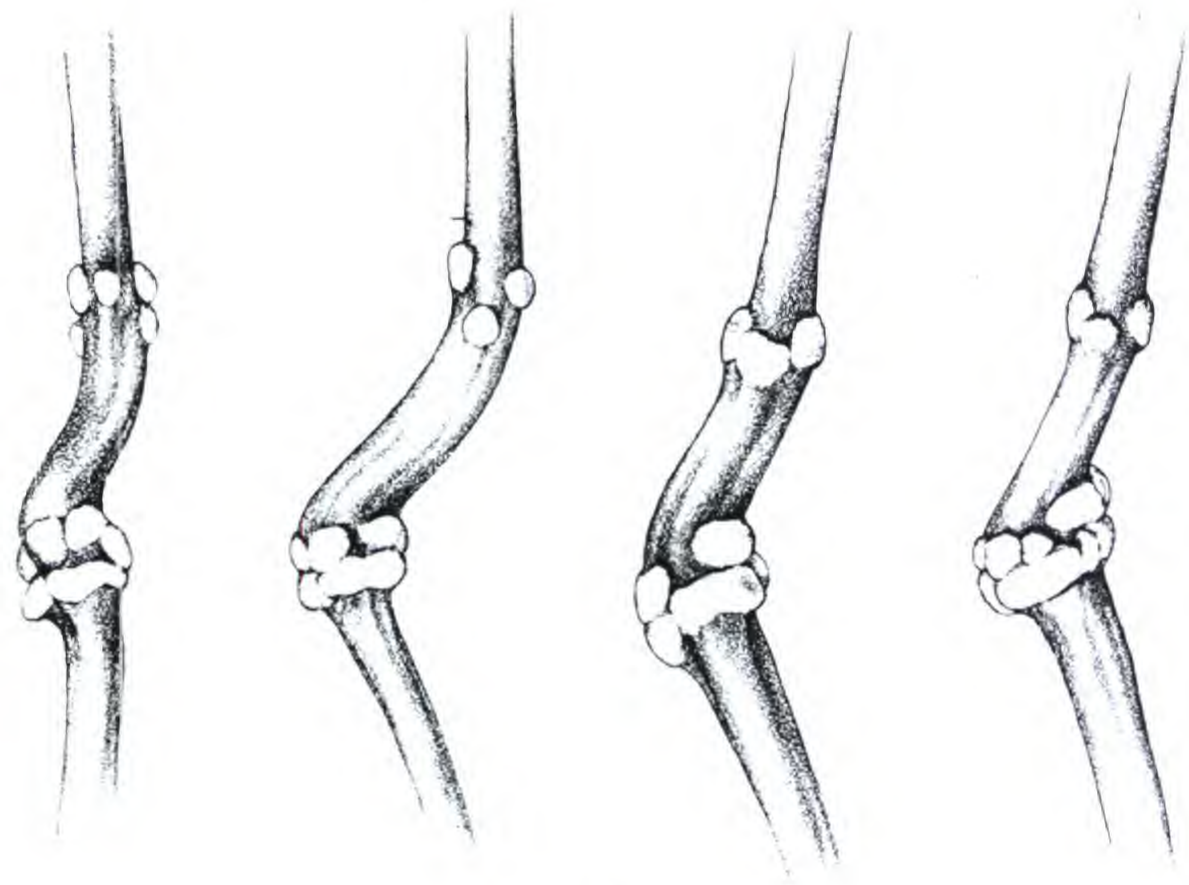

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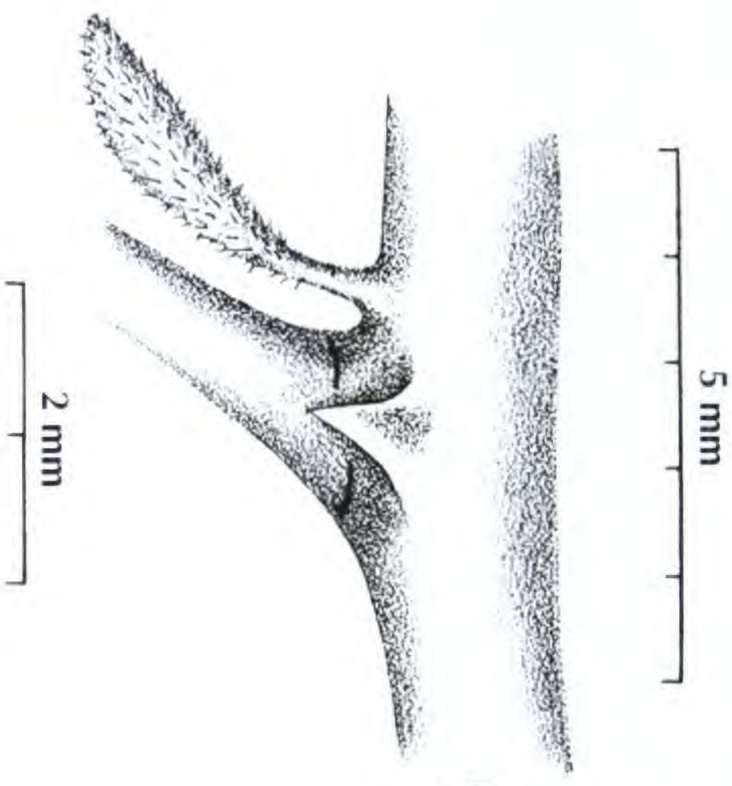

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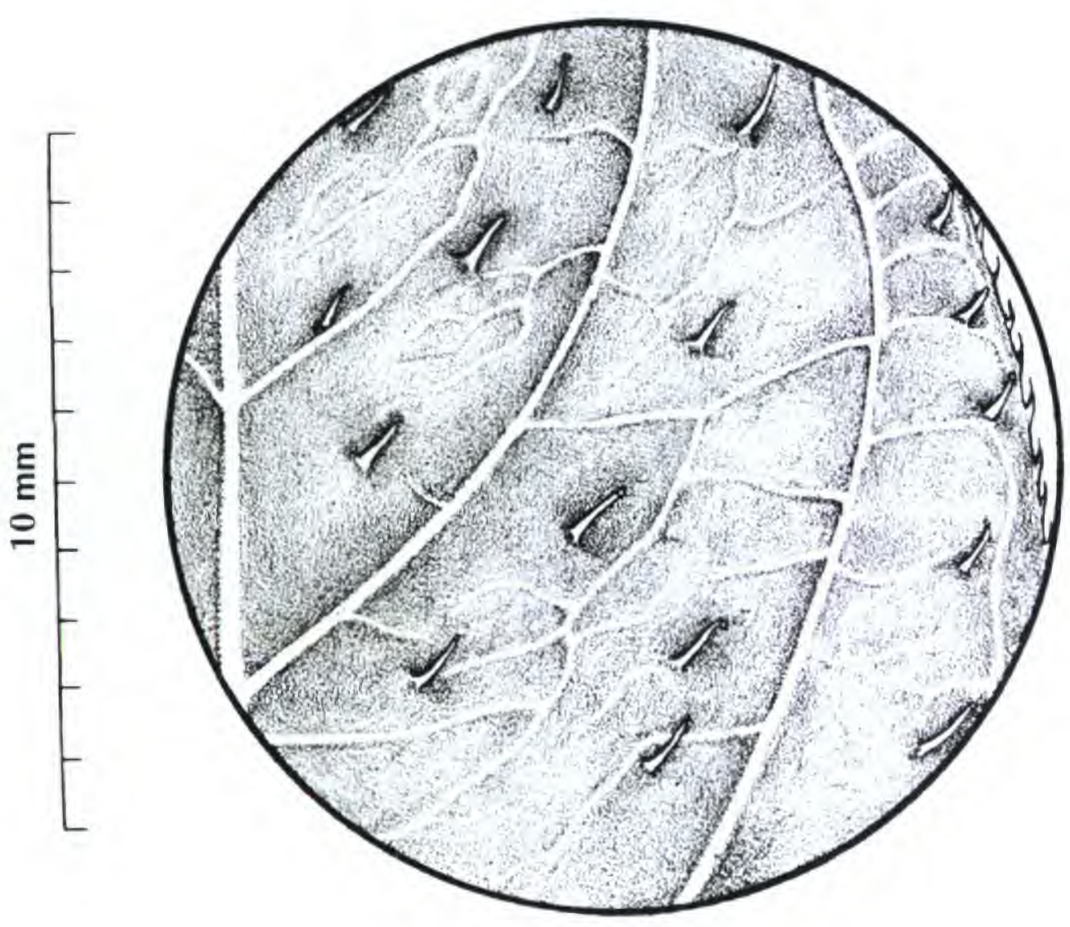

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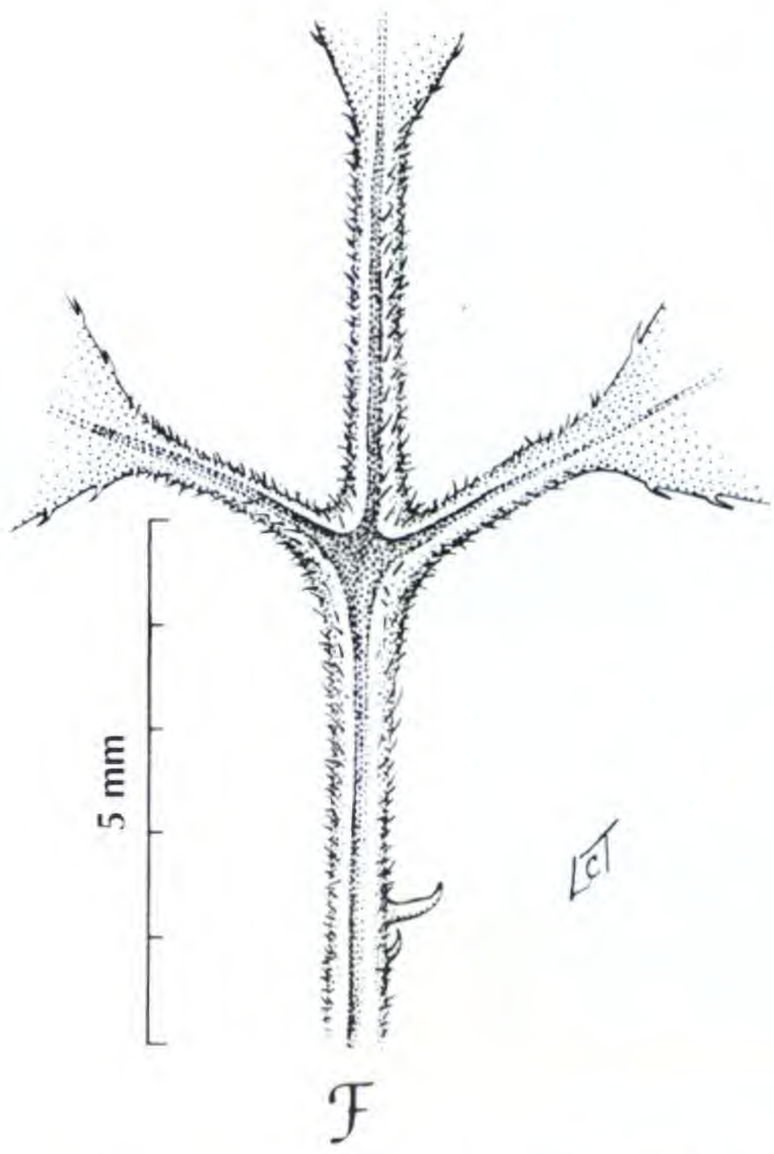

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Figure 2. *Cleome torticarpa*. —A. Seed cross section showing embryo and internal seed cavity. —B. Surface view of seed (*Ruiz Zapata 4138*). —C. Receptacle, from base on up: top of pedicel, sepal scars, petal scars, androgynophore, stamen scar, and base of gynophore [from left to right: *Ruiz Zapata 4138* (2), *Flora Falcón 404*, *Liesner et al. 7791*]. —D. Spine at leaf base (*Ruiz Zapata 4138*). —E. Leaf surface with stiff, short, eglandular hairs. —F. Leaf showing petiolules, and petiole with prickles (E, F, *Ruiz Zapata 4131*).

size, ovate or lanceolate to linear (4 × 2 mm or less), often caducous, with the racemes at times appearing almost ebracteate.

Flowering raceme apices (petal to petal, not including stamens) ca. 4–5 cm diam., with 1–5 open flowers and 8–12 buds at any one time, the latter just preceding anthesis only 8 mm long. *Pedicels* 8–14 mm long. *Flowers* zygomorphic, perfect, or the upper mostly male; *sepals* 4, linear- to lanceolate-caudate, 4–6 × 0.7–1.5 mm, with short white hairs on back and margin, divergent to somewhat reflexed at anthesis; *petals* 4, white (rarely light pinkish because of fading), 12–18 mm long [blades 6–7(–12) × 3–5 mm, the greenish claws 5–8 mm long], the middle pair slightly larger than the lateral, all adaxial and erect, facing outward; *stamens* 6, the upward-arching greenish filaments (15–)18–20(–23) mm long, borne on a distinct, slender, short *androgynophore* ca. 2 mm long (i.e., the filament base fused for 2 mm to the gynophore base; cf. Fig. 2C); receptacle lacking any noticeable nectariferous gland or disc; anthers 3–4 mm, with divergent basal tails, the filaments inserted 1/3 up the anther; *gynophore* filiform, 12–14(–18) mm, carrying an ellipsoid, minutely puberulous, 6–10 × 1 mm ovary with a 1-mm-long style and a subcapitate stigma.

Fruits linear to oblongoid *siliques*, at maturity few on any one raceme (at most 2 or 3, and these often clustered near the raceme base), quite flattened and twisted 1–2 times, 15–27(–36) mm long, 4–6 mm wide, 3 mm thick, subglabrous or glabrous, green, the pale yellowish, longitudinally parallel veins prominent, occasionally anastomosing and sometimes connected by much thinner secondary veinlets; fruit dehiscence ± explosive when, ejecting the seeds, the valves separate suddenly from the replum (placenta), from top down and bottom up, or more commonly either one or both ends remaining permanently attached with the valves bulging outward and especially the lower end of the valves permanently "pinched" into place by the two "arms" of the placenta at the extremely contracted narrow base of the silique; *style* 1 mm long, truncate; *siliques* borne on a slender *pedicel* 10–16 mm long, a distinct *androgynophore* 2–3 mm long, and a slender *gynophore* 14–16(–20) mm long, all ascending together to the extremely narrowly contracted base of the silique which, together with the top of the gynophore, *curves sharply downward* by 90° or more, so that the fruit becomes strongly deflexed at maturity.

Seeds 3–14 per silique, subspherical-reniform, 2.1–2.7 mm long, 2.1–2.9 mm wide, 2.0–2.1 mm thick, exarillate, rusty-brown, verrucose and transversely striatulate (ridged) on back and sides, the cleft membrane narrow, smooth, very thin, flush with the testa except for a slight invagination between the tips of the seed claws, the internal cleft cavity ovoid, small. Testal stomata (under SEM) present (Ruiz Zapata & Escala, 1995). [Recent research with Scanning Electron Microscopy has shown that most cleomoid taxa have scattered stomates on the seed testa (Vanderpool, 1989). According to Ruiz Zapata and Escala (1995), these stomates are present in most of the native *Cleome* species of Venezuela (*C. aculeata* L., *C. anomala* HBK, *C. arborea* HBK, *C.* guianensis Aublet, *C. hassleriana* Chodat, *C. latifolia* Vahl, *C. moritziana* Eichler, *C. parviflora* HBK, *C. pilosa* Bentham, *C. serrata* Jacquin, *C. speciosa* Rafinesque, *C. spinosa* L., *C. torticarpa* Iltis & Ruiz Zapata, *C. viridiflora* Schreber, as well as the introduced African *C. rutidosperma* DC). The only native species apparently lacking testal stomates are *C. stenophylla* Klotzsch ex Urban and *C. stylosa* Eichler, as well as the other two Old World introductions, *C. viscosa* L. and *C. gynandra* L. (Iltis, 1960).]

A slender herbaceous forest-floor mesophyte of the evergreen riparian or gallery forest (selva siempre verde), *Cleome torticarpa* is known only from the "*Cueva de la Quebrada El Toro*" National Park, 10°50′N, 69°07′W, ca. 7 km from the village of La Taza, at ca. 600 m. Here it is locally abundant for perhaps one or two kilometers in the perpetually moist leaf litter along the damp, shaded margins of a small river that, flowing initially underground, emerges from the mouth of the cave (cueva) at the head of the "quebrada." The nearby calcareous rocky slopes are covered with tropical seasonally dry, deciduous forests (bosques mesofilos deciduos, periódicamente húmedos; Hueck, 1960), a vegetation type characteristic of this region. But even though the river is small, only 3 or 4 m wide and 0.5 m deep, it runs all year round, even in the dry season, with the gallery forest floor habitat of this species permanently moist. It is for this reason, apparently, that *C. torticarpa* flowers and fruits intermittently throughout the year.

Cleome torticarpa is distinct and in some ways unique within *Tarenaya*, a section of *Cleome* with about 30 species known for the great similarity of some of its taxa and the usual presence of straight to curved, paired, pseudo-"stipular" spines on the stems and scattered similar ones on petioles and leaves. All, except the African *Cleome afrospina* Iltis (Iltis, 1967) and a questionably native Hawaiian variety of *C. spinosa* Jacquin, are New World species. The main characters distinguishing *C. torticarpa* are its flattened, twisted, few-seeded, short

siliques, which are deflexed by a sharp downward curvature, usually not of the gynophore apex alone but the narrow silique base as well. Noteworthy also is the relatively distinct androgynophore (i.e., the adhesion or fusion of staminal filaments to the base of the gynophore), a character that has repeatedly evolved in the Cleomoideae, both in the Old World (Iltis, 1960) and in the New (Woodson, 1948; Cochrane, 1977, 1978; Iltis & Cochrane, 1989).

Its trifoliolate leaves with long petioles and the greatly elongated, extremely slender racemes with many small, more or less cordate bracts suggest a relationship to *Cleome latifolia* Vahl of the Guyanas and adjoining Amazonian Brazil (Fig. 1G) as well as to the widespread *C. parviflora* HBK (Ruiz Zapata & Iltis, 1998). In fact, *C. latifolia* also is often nearly unarmed and its spines are only rarely prominent. In *C. torticarpa*, spines are extremely rare, only a few specimens of one collection (*Ruiz Zapata & Ruiz 4131*) having minute (0.6 mm long) varnished "stipular" spines (Fig. 2E) and a few ascending thin prickles on the lower side of the petiole. Nevertheless, this fact, and its general overall similarity to the other species cited above, place *C. torticarpa* squarely in section *Tarenaya*.

While vegetatively resembling *Cleome latifolia*, *C. torticarpa* has fruits that are unique in being flattened and "twisted" and certainly in the more or less explosive dehiscence of their siliques, which, though somewhat less explosively than those of *Impatiens*, may disperse the seeds for up to 50 cm (pers. obs. of the second author on cultivated plants at Maracay), a peculiarity unique in Cleomoideae and evidently related to this torsion. *Cleome latifolia* is a somewhat larger, more robust plant, minutely short-puberulent throughout, the fruits included, and has a receptacle adaxially expanded into a nectariferous fleshy bulge, while its slender fruits, cylindrical, not flattened, and usually much longer (6–10 cm), exhibit normal dehiscence, with the valves releasing the seeds by simply falling off. In Venezuela, *Cleome latifolia* has been rarely collected and then only in Estado Bolívar [margen izquierdo del río Cuchivero, Dto. Cedeño, 120 m s.m., *Fernández 1699* (MY, WIS photocopy), *Ruiz Zapata & Ruiz 4695* (MY); Reserva Forestal "La Paragua," márgenes del río Asa, *Blanco 785* (MO, VEN, WIS photocopy)]. There is also a questionable collection from Estado Guárico that needs verification.

Very similar also in its slender, much elongating, bracteate racemes is the variable *Cleome parviflora*, widespread from Mexico to Argentina, but in Venezuela local in moist or wet habitats and absent from regions with a sharply seasonally dry climate. Its fruits vary from slender and elongate to short and thick (a *C. parviflora* variant differentiated by some as C. *micrantha* Desvaux), and, unlike *C. torticarpa*, are cylindrical-torulose, unevenly constricted, and not pronouncedly nerved. Its plants are generally much more robust, much-branched, and often quite spiny, and, most importantly, almost always have at least some leaves that are 5- or, rarely, 7-foliolate, unlike the uniform 3-foliolate leaves of both *C. torticarpa* and *C. latifolia*.

In conclusion, one may speculate on the evolutionary history of *C. torticarpa*, not only its relationships, but also its peculiar and unique explosive dehiscence, and its extreme localization, more so than that of any other of the ca. 80 New World taxa of *Cleome*. Considering its habitat, perhaps it simply evolved from a minute, highly inbred "founder" population that, adapted like most of its more heliophilic relatives in section *Tarenaya* to continuous moisture, is here restricted to a gallery forest along an ever-flowing stream: in short, to a minute climatological "oceanic island" of shaded humidity surrounded by an "ocean" of seasonally dry forest and woodland aridity. It will be the task of future population biologists to find answers to this question.

But this may soon become difficult, for *Cleome torticarpa* is a severely threatened species. On the one hand, along the river within the National Park there is a swimming area much used by people, which results in brush clearing by the administration and trampling by a public eager to take advantage of a clear, spring-fed pool in this hot and arid tropical climate; and from here all Cleomes have disappeared. On the other hand, though the parts of the National Park are fenced, the herds of free-ranging cattle from neighboring haciendas are equally attracted to the lush vegetation near this stream, and even, on occasion, are able to invade the park itself. It may be that *C. torticarpa* is widespread beyond the park's boundaries, on private hacienda lands, but here, too, expanding agricultural pressures from a rapidly growing human population are expected to increase at least in the near future. Finally, we can perhaps console ourselves with the thought that this insignificant, delicate, shade-loving annual with its uniquely explosive fruits would hardly be missed by anyone were it to go extinct. By all accounts, it seems to be, after all, an evolutionary failure. But its extinction would nevertheless represent the loss of one more small piece of that great puzzle of organic evolution, a loss for which each of us, biologist or not, might well feel a sense of mourning.

Paratypes. VENEZUELA. **Falcón**: Distrito Federación, La Taza, selva siempre verde (seasonal evergreen forest), lado del río, Parque Nacional Cueva de la Quebrada "El Toro," 600 m, 23 Feb. 1979 (fl, fr), *Flora Falcón* [*van der Werff & Simonis*] *404* (CORO, MO, WIS); entre rocas, sobre suelo mojado a la orilla del río permanente (más o menos en el lecho, probablemente inundada a veces), ± expuesta al sol, 600 m, 28 Feb. 1979 (fl, fr), *Wingfield 5879* (CORO); mostly evergreen forest, steep, wet valley along river, 600 m, 10°50′N, 69°07′W, 21 June 1979 (fl, fr), *Liesner, González & Wingfield 7766* (MO, VEN); trail going to La Piedra, slope above river, 600–900 m, 22 June 1979 (fl, fr), *Liesner, González & Wingfield 7791* (MO, VEN, WIS); trail to water tank and trail along pipe down to valley pumping station, secondary vegetation with remnants of primary forest slope, 600–900 m, 23 June 1979 (fl, fr), *Liesner, González & Wingfield 7913* (MO, VEN, WIS); 3 m del margen derecho de la Quebrada, más abajo de la estación del Parque, en selva de galería, bajo sombra, 20 Nov. 1982 (fl, fr), *Ruiz Zapata, Parra & Mariño 4057* (MY, NY, US, WIS); en selva de galería, bajo sombra en abundante hojarasca (leaflitter), 21 Aug. 1983 (fl, fr), *Ruiz Zapata & Ruiz 4131* (GH, MER, MO, MY, NY, S, UC, US, VEN, WIS).

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New Series in *Pedicularis* (Scrophulariaceae)

Ludmila I. Ivanina and Tamara N. Popova
Herbarium, Komarov Botanical Institute, Prof. Popov Street 2, St. Petersburg 197376, Russia

ABSTRACT. Three new series of *Pedicularis*, ser. *Maximoviczianae*, ser. *Albertianae*, and ser. *Semenowianae*, are described, and three species, *P. maximoviczii*, *P. chorgossica*, and *P. albertii*, are reported from China.

Some of the Central Asian species of *Pedicularis* were not included in *Flora Reipublicae Popularis Sinicae* (Tsoong, 1963) but were reported later from Dzhungaria by Ivanina (1970). These include *P. albertii* Regel, *P. maximoviczii* Krassnow, and *P. chorgossica* Regel & Winkler. *Pedicularis albertii* and *P. maximoviczii* each belongs to a monotypic series, and the latter species most probably belongs to section *Capitatae* (Prain) Ivanina (Ivanina, 1991), rather than to section *Cyclophyllum* Bunge ser. *Semenowianae* Vvedensky (Vvedensky, 1955). Descriptions and distributions in China of these three species are herein provided.

Tsoong (1963) placed *Pedicularis semenowii* Regel in series *Caucasicae* Maximowicz, but we believe that series *Caucasicae* is not represented in China. *Pedicularis semenowii* and three other Middle Asian species (*P. popovii* Vvedensky, *P. karatavica* Pavlov, and *P. waldheimii* Bonati) belong to series *Semenowianae*. On the other hand, *P. chorgossica* belongs to series *Platyrrynchae* Maximowicz rather than series *Interruptae* Vvedensky, as was determined by Vvedensky (1955).

Pedicularis ser. Maximoviczianae Ivanina & T. N. Popova, ser. nov. TYPE: *Pedicularis maximoviczii* Krassnow.

Radice crassa fasciculata; caule supra collum squamatum ramosissimo ramis dense caespitosis brevissimis glabris oligophyllus; foliis plerisque basalibus longe petiolatis, lamina pinnatisecta, segmentis oblongis; floribus roseo-albis amplis ramos omnes terminantibus breve capitatis; calyce hirsuto campanulato; corollae tubo erecto, galea falcata, ad angulum inferiorem breve truncata et infra apicem breve bidenticulata, labio galeam aequante. Capsula oblique ovato-oblonga cuspidata.

Roots fleshy, fascicled, fusiform, thickened. Stems small, branched basally, branches long, alternate and opposite, crowded. Flowers axillary and apical, 1–3 on long pedicels. Corolla 3–3.5 cm; tube suberect; upper lip erect or slightly bent with small widely triangular teeth, beakless. Capsule obliquely ovate-oblong.

Series *Maximoviczianae* is monotypic and is related to series *Flexuosae* Prain and series *Acaules* Prain. From series *Flexuosae*, it differs in having short stems (5–15 cm tall) and beakless corolla galeas, instead of stems more than 40 cm tall and corolla galeas with robust beaks. From series *Acaules*, it differs in having corolla galeas with 2 marginal teeth and flowers axillary and in apical inflorescences. In contrast, series *Acaules* has corolla galeas without marginal teeth and flowers exclusively axillary. Vvedensky (1955) placed *Pedicularis maximoviczii* in series *Seminovianae* Vvedensky, but species of this series typically have opposite or verticillate lower stem leaves and subcapitate inflorescences, instead of alternate lower stem leaves and non-capitate inflorescences characteristic of *P. maximoviczii*. In our opinion, series *Maximoviczianae* and *Semenowianae* are unrelated.

Pedicularis maximoviczii Krassnow, Zap. Russk. Geogr. Obz. 19: 339. 1888; Scripta Bot. Horti Univ. Imp. Petrop. 2: 18. 1889. TYPE: China. Xinjiang: [Dzhungaria], Muzart, 1886, *Krassnow s.n.* (lectotype, here designated, LE).

Herbs perennial. Roots fleshy, fusiform-thickened. Stems 5–15 cm tall, branched basally, glabrous. Basal leaves long-petiolate, 1–5 cm, lanuginose; stem leaves alternate, uppermost subopposite, crowded near inflorescences; blade 2–5 cm, lanceolate, pinnatisect, segments oblong, pinnatipartite. Flowers axillary, 1–3 with short pedicels on branches and 2 or 3 with long pedicels on apical inflorescences; bracts leaflike, petioles mostly pubescent. Calyx campanulate, membranous, densely pubescent, 1.2–1.5 cm; lobes narrowly triangular, serrate; tube 1.5× longer than lobes. Corolla reddish white, glabrous, 3–3.5 cm; tube straight, as long as upper lip; upper lip falcate, with 2 triangular teeth; lower lip as long as upper. Filaments 2 glabrous and 2 villous. Ovary conical. Capsule obliquely ovate-oblong.

Flowering March–May, fruiting June–July.

Additional Chinese specimens examined. CHINA. **Xinjiang:** "prope fontes fl. Muzart," *Krassnow s.n.* (LE); "prope fontes fl. Tekess," *Krassnow s.n.* (LE).

Habitat and distribution. Stony and gravelly slopes; 3000–3600 m. Xinjiang [Kazakstan, Kyrgyzstan].

Pedicularis ser. Platyrrhynchae Maximowicz, Bull. Acad. Imp. Sci. Saint-Petersbourg, ser. 3, 32: 586. 1888. TYPE: *Pedicularis chorgossica* Regel & Winkler.

Roots vertical, stout, branched. Stems several, erect, stout, 4-angular along upper part. Stem leaves 3–6, pinnatisect. Inflorescences spicate, interrupted. Calyx coriaceous or membranous, lobes 5. Corolla tube decurved apically, longer than calyx; upper lip bent, beak conical, apex with 2 marginal teeth; lower lip to 1.5–2× shorter than upper. Capsule oblong-lanceolate or ovate, subsymmetrical.

The series includes three species distributed in Siberia, China, Kazakstan, and Kyrgyzstan, and one of its species, *Pedicularis chorgossica*, is recorded here from China. Series *Platyrrhynchae* is related to series *Verticillatae* Maximowicz, from which it differs in having the corolla tube decurved apically and galeas with conical beak and 2 marginal teeth, instead of the corolla tube decurved basally and galeas that are beakless and toothless. *Pedicularis platyrrhyncha* Schrenk is a synonym of *P. interrupta* Stephan ex Willdenow, but the series name *Platyrrhynchae* is legitimate and has priority over series *Interruptae* Vvedensky (1955).

Pedicularis chorgossica Regel & Winkler, Acta Horti Petrop. 6: 350. 1879. TYPE: China. Xinjiang: Dzhungaria, "Mittlerer Chorgos," 1500–1800 m, 15 May 1878, *A. Regel s.n.* (lectotype, here designated, LE).

Herbs perennial. Roots vertical, with several stout branches. Stems 20–35 cm tall, 1–8, simple, erect, stout, glabrous, 4-angular in upper part. Stem leaves verticillate in 3 or 4 nodes, lower long petiolate, upper sessile; petiole and midrib winged; blade pinnatisect or pinnatipartite, segments lanceolate. Inflorescences spicate, to 10 cm; bracts leaflike, hirsute at base, upper shorter than flowers. Calyx cylindric, 6–9 mm, membranous, scabrous; lobes 5, lanceolate, acute, entire or callose-serrulate, to 2–3× shorter than tube. Corolla reddish lilac, 2.2–2.5 cm; tube ± straight; upper lip falcate apically, beak short with small teeth; lower lip ca. 1.5× shorter than upper, middle lobe smaller than lateral pair, curved. Filaments glabrous. Capsule ovoid, subsymmetrical, ca. 1–1.3 cm, apex acuminate.

Flowering June–July, fruiting July–August.

Additional Chinese specimens examined. CHINA. **Xinjiang:** Dzhungaria, "Mittlerer Chorgos," 1500–1800 m, 16 May 1878, *A. Regel s.n.* (LE); "Mittlerer Dschin-Zaganlunge," 1200–1800 m, 7 June 1879, *A. Regel s.n.* (LE); "Naryngol am Zaganussu (Dschin)," 1800–2450 m, 10 June 1879, *A. Regel s.n.* (LE); "Borgatypass," 2450–2750 m, 7 June 1879, *A. Regel s.n.* (LE); "Kokkamyrgebirge, nord Kuldsha," 2450–2750 m, 29 July 1878, *A. Regel s.n.* (LE).

Habitat and distribution. Dry rocky and sandy slopes; 2300–2900 m. Xinjiang [Kyrgyzstan].

Pedicularis ser. Albertianae Vvedensky ex Ivanina & T. N. Popova, ser. nov. TYPE: *Pedicularis albertii* Regel.

Perennia; radix abbreviata, fibris funiculatis crassis; caules 1–3, erecti, 5–20 cm alti; folia radicalia pinnatisecta, ovata vel lanceolata; caulina alternata, 1–3, brevi petiolata; inflorescentia spiciformis, 5–10 cm longa; corolla roseo purpurea, 1.5–1.7 cm longa, tubus infractus, galea recta, edentula, labio parvo 5 × 5 mm lobo medio parvo. Capsula oblique ovata.

Herbs perennial. Roots short, thick. Stems 1–3, erect, 5–20 cm tall. Basal leaves pinnatisect, ovate to lanceolate; stem leaves alternate, 1–3, short-petiolate. Inflorescences spicate, 5–10 cm. Corolla rose-purple, 1.5–1.7 cm; upper lip toothless, straight; lower lip shorter, 5 × 5 mm, middle lobe short. Capsule oblique-ovate.

Series *Albertianae* is monotypic, and Vvedensky (1955) did not provide a Latin diagnosis for it. It is most closely related to series *Flammeae* Prain, from which it differs in having basipetal inflorescences, the corolla tube curved at the calyx throat, and small (ca. 5 × 5 mm) corolla lips. In contrast, series *Flammeae* has centrifugal inflorescences, the corolla decurved just below the galea, and wider corolla lips.

Pedicularis albertii Regel, Tran. Petersb. Bot. Sada 6: 353. 1880.

Herbs perennial. Rootstock fascicled, fusiform. Stems (5–)10–20 cm tall, 1 or 2, simple, crispate-arachnoid pubescent. Basal leaves lanceolate, crispate-hairy along veins and petiole, pinnatisect; segments oblong-lanceolate, imbricate-lobed, dentate, acute; stem leaves 1–3, sessile or subsessile. Inflorescences 4–10 cm, dense; lowermost bracts similar to upper leaves, middle ones oblong-lanceolate, entire, uppermost linear. Calyx campanulate, 5–6 × ca. 10 mm, membranous, villous on veins; teeth triangular-lanceolate, acute, entire. Corolla pink-purple, 1.5–1.7 cm, tube curved; upper lip straight, not beaked, toothless, ca. 2× longer than lower lip; lower lip 3-lobed, ca. 5 × 5 mm, glabrous. Fila-

ments glabrous or with solitary short hairs. Capsule ca. 1.2 cm, oblique-ovoid.

Flowering April–June, fruiting May–July.

Chinese specimens examined. CHINA. **Xinjiang:** Dzhungaria, "Ober Lauf des Taldy," 2400–2750 m, 17 May 1879, *A. Regel s.n.* (LE), 2750–3050 m, 20 May 1879, *A. Regel s.n.* (LE); "Hochebene an den Quellen vos Dschurgalan et Pilutschi," 1800 m, 24 Apr. 1879, *A. Regel s.n.* (LE); "Pilutschipass," 26 Apr. 1879, *A. Regel s.n.* (LE); Orient Tian-schan, Bogdo-ula," 26 Apr. 1959, *Junatov & Yan-J-Fan 45* (LE).

Habitat and distribution. *Abies* and broad-leaved forests. Xinjiang [Kazakstan, Kyrgyzstan].

Pedicularis ser. Semenowianae Vvedensky ex Ivanina & T. N. Popova, ser. nov. TYPE: *Pedicularis semenowii* Regel.

Radix crassa fasciculata, rami fusiformiter incrassatis; caule brevis; folia radicalia paucissima pinnatipartita rhachi serrata, caulina opposita vel verticillata; corolla ultra 20 mm longa, tubus ad calycis faucem incurvis vel rectus, galea recta aequilata plus triplo longior, galea apice obtuso vel brevius rostrata et 2-denticulata, labium galeam aequans ovarium globosum, capsule oblique late ovata.

Roots fascicled, thick, branches fusiform. Stem short. Basal leaves pinnatipartite, rachis serrate; stem leaves opposite or whorled. Corolla more than 2 cm; tube curved at calyx mouth or straight; upper lip straight, 1–3× longer than broad; lower lip obtuse to short-beaked at apex, 2-toothed, as long as globose ovary. Capsule obliquely broad-ovate.

Vvedensky (1955) did not provide a Latin diagnosis for series *Seminowianae*, and the name is herein validated. Series *Semenowianae* is most closely related to series *Caucasicae* Maximowicz and differs by its fleshy fusiform roots, slender stems, inflated fruiting calyx, and corollas more than 2 cm long. Series *Caucasicae* has conical roots, stout stems, a non-inflated fruiting calyx, and corollas less than 2 cm long.

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Crepidium flavovirens, a New Species of Orchidaceae from Australia

David L. Jones and Mark A. Clements
Centre for Plant Biodiversity Research, Australian National Herbarium,
CSIRO, Box 1600, Canberra, Australia, 2601

ABSTRACT. Studies of herbarium specimens and drawings of *Crepidium* Blume from New Guinea and Indonesia show that a species from Australia, previously confused with *C. xanthochilum* (Schlechter) Szlachetko, is undescribed. It is here described as new and illustrated.

Our studies support the transfer to *Crepidium* Blume by Szlachetko (1995) of a large number of species formerly included in the New World genus *Malaxis* Swartz. Species of *Crepidium* can be distinguished by plicate leaves (flat and smooth in *Malaxis*), elongated, fleshy stems (short, bulbous stems in *Malaxis*), elongated basal auricles on the labellum (base cordate to rounded in *Malaxis*), and a prominent sac-like concavity at the labellum base (absent in *Malaxis*). *Crepidium*, which consists of ca. 215 species, is distributed from India to Tahiti and Japan to Australia.

Crepidium xanthochilum (Schlechter) Szlachetko, described as *Microstylis xanthochila* Schlechter from material collected near Erimahafen in New Guinea (Schlechter, 1905), was considered to extend to northeastern Queensland (Dockrill, 1969, 1992; Clements, 1989). A recent study of an isotype of *Microstylis xanthochila* at BRI shows that the Australian material previously included with that species is specifically distinct. A study of the specimens of the *Malaxis* alliance held at BO, BRI, CANB, and LAE, together with drawings by Schlechter (1905) and J. J. Smith (1905, 1909, 1911, 1912, 1915, 1916, 1932, 1936), shows that the Australian taxon does not match any known from New Guinea or Indonesia, and it is here described as new.

Crepidium flavovirens D. L. Jones & M. A. Clements, sp. nov. TYPE: Australia. Queensland: Cook District: near Malanda, 19 Feb. 1990, *M. Brown (Jones 5677)* (holotype, CANB). Figure 1.

Species nova affinis *C. xanthochilae* (Schlechter) Szlachetko, sed foliis multo majoribus (lamina ad 25 × 6 cm); floribus multo majoribus (6 × 5 mm) virido-flavis; segmentis perianthi majoribus (sepale dorsale 6 × 2 mm; sepalis lateralibus 4.5 × 2.5 mm; petalis 5 × 0.8 mm); et labello sine lobe mediano protruso, dentibus apicalibus multo longioribus (ca. 1.5 mm longis), differt.

Terrestrial herb forming loose clumps to ca. 25 cm tall, consisting of 2–6 stems. Stems subcylindrical, consisting of 5–11 nodes, 10–25 × 1–1.7 cm, semi-erect, straight or curved, narrowed slightly at the base, tapered to the apex, pale green, partially covered by scarious sheathing bracts. Leaves 4–10, semierect in a narrow, flabellate arrangement; petiole 1–6 × ca. 0.6–1 cm, deeply canaliculate; lamina asymmetrically ovate-lanceolate, 10–25 × 2.5–6 cm, falcate, plicate, with margins entire to slightly undulate, and apex acute to acuminate. Inflorescence 12–35 cm long, erect, many-flowered, the flowers densely crowded; peduncle of similar length to the rachis, shallowly furrowed, with numerous sterile bracts; sterile bracts very narrowly subulate, 6–14 mm long, ca. 1.3 mm wide, spreading or recurved, acute to acuminate; fertile bracts similar but smaller. Pedicel plus ovary 3–7 mm long, filiform, straight or curved, porrect to suberect. Flowers yellowish green, 7–8 × 5–7 mm. Dorsal sepal narrowly oblong-elliptical to narrowly oblong-lanceolate, 5–6 × ca. 2 mm, erect to recurved, with margins strongly revolute, and apex obtuse. Lateral sepals oblong-obovate, 4–4.5 × 2–2.5 mm, reflexed behind the labellum; apex obtusely apiculate. Petals narrowly linear, 4.5–5 × ca. 0.8 mm, spreading or recurved, with margins partly revolute, and apex truncate or emarginate. Labellum hippocrepiform, 5.5–6 × ca. 5 mm, at right angles to the rachis, with two erect, deltate, divergent, auricular lobes ca. 3 mm long flanking the column, apex with 6–8, linear-subulate teeth to 1.5 mm long. Column porrect from the end of the ovary, ca. 3 × ca. 2.8 mm; column wings higher than the anther, curved forward apically, obtuse. Stigma transversely ovate, ca. 1.8 mm across, sunken. Anther ovate, ca. 1 × 1.7 mm, purplish. Pollinia obovoid, ca. 0.25 mm long, yellow, waxy. Capsules narrowly obovoid, 5–6 × 2–3 mm, porrect to erect.

Distribution and ecology. Restricted to northeastern Queensland where it is distributed dis-

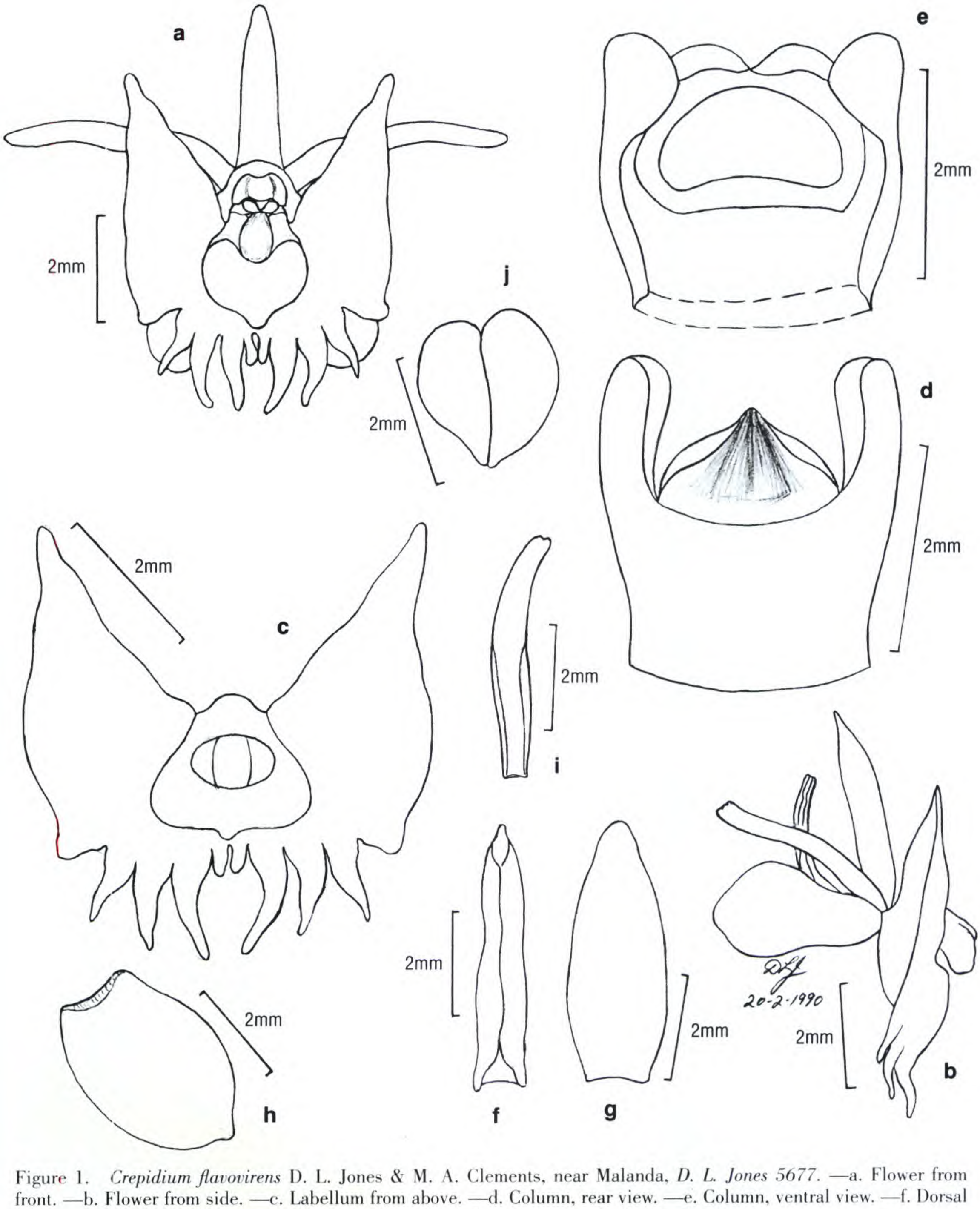

Figure 1. *Crepidium flavovirens* D. L. Jones & M. A. Clements, near Malanda, *D. L. Jones 5677*. —a. Flower from front. —b. Flower from side. —c. Labellum from above. —d. Column, rear view. —e. Column, ventral view. —f. Dorsal sepal. —g. Dorsal sepal, flattened out. —h. Lateral sepal. —i. Petal. —j. A pair of pollinia.

junctly between the Mossman Gorge and the Johnstone River. Grows in leaf litter and gravelly loam in moist, humid situations in rainforest, particularly on steep slopes near streams, around soaks and seepage areas and among boulders. Altitude: 200–750 m. Flowering period: January to May.

Recognition. *Crepidium flavovirens* differs from *C. xanthochilum* by having much larger leaves (lamina to 25 × 6 cm vs. to 12 × 4.5 cm in *C. xanthochilum)*; greenish yellow flowers (vs. reddish brown to muddy brown in *C. xanthochilum*); much larger flowers (6 × 5 mm vs. 3 × 2 mm in *C. xanthochilum*); larger perianth parts (dorsal sepal 6 × 2 mm vs. 2.5 × 1.8 mm; lateral sepals 4.5 ×

2.5 mm vs. 2.5 × 1.6 mm; petals 5 × 0.8 mm vs. 2.8 × 1 mm); and the labellum lacking a protruding, bidentate, medial lobe, and with much longer apical teeth (ca. 1.5 mm long vs. 0.6 mm long in *C. xanthochilum*).

Conservation status. Occurs in small populations and rare, but conserved; suggest 3KC (Briggs & Leigh, 1996).

Etymology. Derived from the Latin *flavovirens*, yellowish green, in reference to the flower color.

Paratypes. AUSTRALIA. **Queensland:** SFR 756, Kaarru Logging Area, 11 Mar. 1991, *B. Gray 5290* (QRS); State Forest Reserve 310, Gadgarra, Swipers Logging Area, 28 Aug. 1993, *B. Gray 5712* (QRS); Jordon Ck, 16 Apr. 1995, *L. J. Roberts s.n.* (CANB).

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Three New Species of *Passiflora* (Passifloraceae) from Ecuador and Notes on *Passiflora viridescens*

Peter M. Jørgensen and John M. MacDougal
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. Three species are described as new, viz., *Passiflora trochlearis*, *P. smilacifolia*, and *P. luzmarina*. Ten species are reported as new for the country, viz., *Ancistrothyrsus hirtellus*, *P. tessmannii*, *P. putumayensis*, *P. pittieri*, *P. viridescens*, *P. biflora*, *P. candollei*, *P. glaberrima*, *P. caerulea*, and *P.* aff. *kermesina*. Five species are mentioned that appeared in the literature since the publication of the Passifloraceae in the *Flora of Ecuador* as either new taxa or as extensions of distribution into Ecuador, viz., *P. morifolia*, *P. brachyantha*, *P. linda*, *P. jatunsachensis*, and *P. chrysosepala*. Three taxa had misapplied names in the flora; these misunderstandings are rectified. The total number of genera and species in Ecuador is 3 and 92, respectively, an increase of 15 taxa, or 20% in less than 10 years.

RESUMEN. Se describen *Passiflora trochlearis*, *P. smilacifolia* y *P. luzmarina* como nuevas. Las diez especies siguientes son, por primera vez, reportadas para el Ecuador: *Ancistrothyrsus hirtellus*, *P. tessmannii*, *P. putumayensis*, *P. pittieri*, *P. viridescens*, *P. biflora*, *P. candollei*, *P. glaberrima*, *P. caerulea* y *P.* aff. *kermesina*. Las cinco especies siguientes han sido reportadas en la bibliografía desde la publicación de la "Flora of Ecuador": *Passiflora morifolia*, *P. brachyantha*, *P. linda*, *P. jatunsachensis* y *P. chrysosepala*. Tres taxones fueron tratados bajo nombres equivocados en la Flora; estas equivocaciones se rectifican aquí. El número total de géneros y especies en el Ecuador son 3 y 92 respectivamente, ésto significa un incremento de 15 taxones, o del 20% en menos de 10 años.

Since the publication of Passifloraceae in the *Flora of Ecuador* (Holm-Nielsen et al., 1988), Escobar (1992), MacDougal (1994), Panero (1996), and Schwerdtfeger (1997) reported *Passiflora brachyantha* L. K. Escobar, *P. morifolia* Masters, *P. linda* Panero, *P. jatunsachensis* Schwerdtfeger, *P. chrysosepala* Schwerdtfeger, and *P. ulmeri* Schwerdtfeger, respectively. Three misapplications of names made in the *Flora of Ecuador* (Holm-Nielsen et al., 1988) are here rectified, and *P. ulmeri* is synonymized with *P. viridescens* L. K. Escobar. We are here describing 3 new species and can report the following 10 as new for the country: *Ancistrothyrsus hirtellus* A. H. Gentry, *Passiflora tessmannii* Harms, *P. putumayensis* Killip replaces *P. arborea* Spreng sensu Holm-Nielsen et al. (1988), *P. pittieri* Masters, *P. viridescens* L. K. Escobar, *P. biflora* Lamarck, *P. candollei* Triana & Planchon, *P. glaberrima* (Jussieu) Poir., *P. caerulea* L., and *P.* aff. *kermesina* Link & Otto.

The *Flora of Ecuador* included 2 genera and 77 species, and listed 1 additional genus as expected, but not documented. The total number of Passifloraceae in Ecuador is now 3 genera and 92 species. We describe the new species and emend the description of *Passiflora viridescens* to be able to use the information in the *Catalogue of Vascular Plants of Ecuador* (Jørgensen & León, in prep.). The cited author of each new species provided the respective descriptions.

Passiflora trochlearis P. Jørgensen, sp. nov. TYPE: Ecuador. Pichincha: Reserva ENDESA, Quito–Puerto Quito road at km 113, 650–800 m, 0°03′N, 79°07′W, 23 Jan. 1987 (fl), *P. Jørgensen 61637* (holotype, QCA; isotypes, AAU(3), MO). Figure 1.

Haec species a *Passiflora venosa* Rusby petiolis longioribus; glandulis, supra petiolos et costas oblongis; inflorescentia axillari ex cyma centrali in cirrhum longum evoluta et cymis lateralibus brevibus constante differt.

Liana, stem to 1.5 cm diam., puberulent, indument light brown, to 0.1 mm. Stipules 1.5 mm, deltoid, very early deciduous; petioles 2.0–4.0 cm, the glands 2 × 0.7 mm, elliptic, scarlike, reddish brown, confined to the midrib at junction between leaf blade and petiole; leaf blades 6.5–14.7 × 4.0–9.5 cm, unlobed, ovate, entire, the base truncate or rounded, the apex acute, chartaceous, 6–10 light brown lateral nerves per side, above green and pubescent along nerves, below olivaceous green, white-puberulent. Inflorescences axillary, simple or compound dichasiums, the central cyme or flower developed into a long-lasting tendril, old tendrils with barely visible scars from the lateral cymes, apparently a maximum of two flowers flowering per

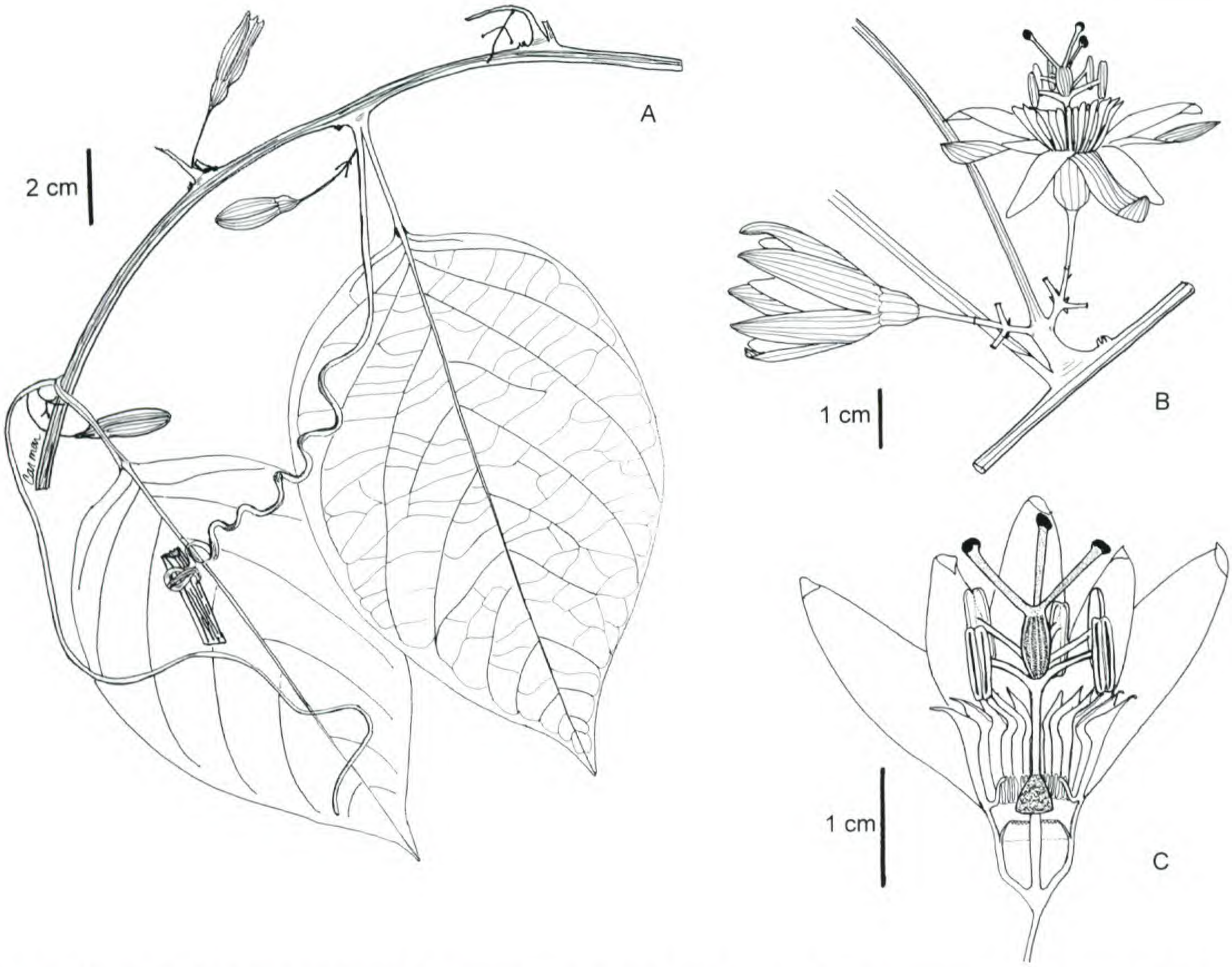

Figure 1. A–C *Passiflora trochlearis* P. Jørgensen. —A. Habit with buds. —B. Inflorescence. —C. Flower. (A–C, *P. Jørgensen 61637*).

node at one time, lateral cymes placed at base of tendril or up to 1.0 cm from base; bracts 0.8–1.5 × 0.3 mm, triangular, light brown puberulent. Flowers 4.0–5.0 cm diam.; hypanthium 1.0–1.3 cm long, 1.0–1.3 cm wide at mouth, campanulate, whitish green, white puberulent outside; sepals 2.0–2.5 × 0.5–0.6 cm, narrowly oblong, obtuse, whitish green, 5-nerved, glabrous; petals 1.3–1.8 × 0.4–0.5 cm, narrowly oblong, obtuse, white; outer corona elements 0.9–1.1 cm, straight, trigonous, subdolabriform, yellowish with purple spots, margin irregular; inner corona elements 1.5 mm, filiform, yellow; operculum placed 6 mm from base of hypanthium, erect for 2 mm then horizontal, margin dentate; androgynophore 1.7–2.0 cm, green with a purple conical trochlea 0.8–1.2 cm from base, between operculum and inner corona series; ovary ellipsoid, ten-ribbed, white puberulent; styles 0.9–1.0 cm, puberulent. Fruit unknown.

Passiflora trochlearis is from the coastal lowlands of Ecuador, known only from the type locality in the tropical rainforest reserve known as ENDESA. This area is part of the Ecuadorian portion of the Choco biogeographical zone; see Jørgensen and Ulloa (1989) for further information on the flora in this area. At the type locality *P. trochlearis* occurs together with *P. macrophylla* Masters and *P. pittieri* Masters.

Passiflora trochlearis is named after its purple trochlea, a striking feature on a light green androgynophore. It belongs to the subgenus *Astrophea* (DC.) Masters and resembles *P. venosa* Rusby from Bolivia, *P. tessmannii* Harms and *P. cirrhipes* Killip from Peru, and *P. rhamnifolia* Masters from Minas Gerais, Brazil. It differs clearly from these species by its larger flowers, different inflorescence, and longer petioles; further differences are given in Table 1. *Passiflora trochlearis* cannot be keyed out in the *Flora of Ecuador*, for it does not fit in any of the first numerals of the key for the subgenus *Astrophea*. When using Escobar's comprehensive key to subgenus *Astrophea* (Escobar, 1994), in the first half it keys out as *P. rhamnifolia*, in the latter half as *P. venosa*. The presumed ancestral character

Table 1. Comparison of *Passiflora trochlearis* and its closest relatives.

Character/Species	*P. rhamnifolia*	*P. tessmannii*	*P. venosa*	*P. cirrhipes*	*P. trochlearis*
Petiole length in cm	1.3–3.0	0.5–1.5	1.5	0.9–1.5	2.0–4.0
Position and shape of petiolar glands	on petiole, oblong	on base of leafblade between midrib and margin, oblong to triangular	on base of leafblade between midrib and margin, triangular	on base of leafblade between midrib and margin, oblong	glands at junction of blade and petiole, restricted to petiole and midrib, oblong
Leaf texture	subcoriaceous	membranaceous	subcoriaceous	membranaceous	membranaceous
Number of peduncles per flowering node	1	1–2	1–2	1–2, or a simple dichasium where the central flower is developed into a tendril	2–6, simple or compound dichasium, central dichasium or flower transformed into a tendril
Peduncle and floral stipe length in mm	12, 16 (fr)	2, 6–7 (fl)	4, 11 (fl); 7, 13 (fr)	6–17, 13 (fl)	15–18, 9–12
Hypanthium length	6 mm	8–11 mm	5–6 mm	7–8 mm	10–13 mm
Petal length relative to sepals, and color	shorter, white	equal, color unknown	longer, diagnosis says purple? (probably white)	shorter, white	shorter, white
Number of corona series	2	2	2	3	2
Shape and length of outer corona in mm	subdolabriform, 10	corona falcate, 6–7	subdolabriform, 11	subdolabriform, 9–10	subdolabriform, 9
Trochlea shape, size in mm (width of trochlea, androgynophore below, and above), and color	annular fusiform, 2.3/1.8/1.8 (fr), red	annular flat, disk-shaped, 3.1/1.8/0.9 (fl), unknown	annular fusiform, 2.1/1.8/1.8 (fr) 1.6/1.3/1.3 (fl), unknown	absent	annular, conic, 3.1/1.2/0.8 (fl), purple
Ovary	densely pubescent, fine straight trichomes	velutinous, light brown trichomes	pubescent, yellow brown trichomes	densely pubescent, yellow to reddish trichomes	puberulent, with white trichomes
Length of styles in mm	8–9	4–6	7	5–6	9–10

state of the tendril and pedicels sharing a common peduncle was used by Killip (1938) to place *P. cirrhipes* in its own section *Cirrhipes* Killip (section name invalidly published, no Latin description). *Passiflora trochlearis* would fall within this group by Killip's criterion. However, we doubt that a section based on this character could be maintained separate from section *Pseudoastrophea* (Harms) Killip, where the other mentioned species are placed.

Paratype. ECUADOR. **Pichincha:** Reserva Forestal ENDESA, Río Silanche, Corporación Forestal Juan Manuel Durini, km 113 de la carretera Quito–Pto. Quito, faldas occidentales, a 10 km al Norte de la carretera principal, 0°05′N, 79°02′W, 650–700 m, 20 Mar. 1985 (fl), *Jaramillo 7539* (QCA).

Passiflora smilacifolia J. MacDougal, sp. nov. TYPE: Ecuador. Napo: 17 km W of Lumbaqui, 70 km W of Lago Agrio, 1130 m, 4 Nov. 1974 (fr), *A. Gentry 12447* (holotype, QCA; isotype, MO).

Haec species *Passifloram lanceariam* Masters simulans sed ab ea fructu seminibusque minoribus atque gemma vegetativa prophyllo unico obtecta differt; a *P. cuspidifolia* Harms lamina foliari subtus glabra subglabrave atque ovario glabro differt.

Vine, glabrous to glabrescent throughout, or microscopically sparsely pubescent with trichomes 0.04–0.1(–0.2) mm on shoot tip, nodes, petioles, and under leaf; stem subterete to compressed, sometimes slightly scabrous, drying striate. Prophylls of the vegetative ramifying bud 1, lateral. Stipules 1.5–3.5 × 0.3–0.5 mm, linear triangular, falcate; petioles 1.4–2.5 cm, eglandular; leaf blade 4.5–9.0 × 1.5–5.5 cm, elliptic, unlobed to obscurely trilobed, 3-nerved, acute to acuminate, base cuneate to rounded-cuneate, glossy and usually variegated along the nerves above; ocellate beneath with 2 conspicuous nectaries at base of nerves and 6–10 others mostly on the distal ⅔, these sometimes raised into conspicuous bumps adaxially; (leaves of juveniles lanceolate, unlobed, acuminate, always variegated; leaves of seedlings 3-lobed, the lobes subequal, variegated, purple beneath). Peduncles 0.4–1.5 cm, solitary or in pairs; bracts 0.5–1.2 mm, setaceous; floral stipe 0.6–1.2 cm, to 1.4 cm in fruit. Flowers 3.5 cm diam.; sepals 1.6–1.8 × 0.9 cm, broadly triangular, obtuse, light green outside, whitish green inside; petals 1.2–1.3 × 0.5 cm, lanceolate, obtuse, white; corona biseriate, the outer series white with a reddish or purplish band subapically; limen annular; androgynophore 6–8 mm, the area between limen and base of androgynophore puberulous; filaments purple or white; ovary glabrous, green; styles purple; stigma green. Fruits 2.5–3.0 × 2.0–2.7 cm, globose to widely ellipsoid, glabrous. Seeds 4.2–4.5 × 2.8–3.0 mm, obovate, symmetric or very slightly obcampylotropous, transversely rugulose with 6–9 sulci.

This new species in section *Decaloba* was described in the *Flora of Ecuador* (Holm-Nielsen et al., 1988) under the misapplied name *P. lancearia*, and was accompanied by an excellent illustration. *Passiflora lancearia* ranges from Chiapas, Mexico, to Panama and differs by its large seeds (4.8–6.7 × 4–6.6 mm) and, notably, 2 equal prophylls of the axillary bud. Also similar to the new species is *P. cuspidifolia*, which differs by its pilose ovary, pilosulous underside of the leaf, obvious nectar ring, and glabrous limen (Holm-Nielsen et al., 1988). *Passiflora viridescens* L. K. Escobar can have similar unlobed, lanceolate leaves, but those are never variegated; the green flowers of that species are pendent on long peduncles.

The leaves at reproductive nodes are typically twice as long as wide, but can be up to four times as long, especially in juveniles. In the type, the laminar nectaries appear as conspicuously raised bumps on the top of the leaf, and may thus also function as heliconiine egg-mimics (Gilbert, 1982).

Of the specimens cited in the *Flora of Ecuador*, we have only one now at hand; this is designated as the type.

Specimens examined. ECUADOR. **Napo:** Estación Biológica Jatun Sacha, Río Napo, 8 km al E de Misahuallí, 450 m, 1°04′S, 77°36′W, 23–27 June 1987 (juvenile), *C. E. Cerón 1719* (MO, QCNE). **Pastaza:** Km 1–3 on trail Mera–Colonia Jativa, 1100 m, *Harling et al. 14727* (GB); Puyo–Macas road, 5 km SE of Veracruz, 950 m, *P. Jørgensen & Lægaard 56475* (AAU, QCA, QCNE).

Passiflora viridescens L. K. Escobar, Phytologia 66: 81. 1989.

Passiflora ulmeri Schwerdtfeger, Hausknechtia 6: 46. 1997. TYPE: Ecuador. Loja: Saraguro–Loja road km 39, 2500 m, 6 Sep. 1996, *Schwerdtfeger 96090602* (holotype, QCA not seen; isotypes, AAU not seen, GOET not seen, MO, QCNE not seen, US not seen).

Passiflora viridescens was described as an endemic species known only from the type locality in northern Peru. Since its publication more material has become available, particularly from Ecuador, and it has become evident that this is actually the species treated by the *Flora of Ecuador* (Holm-Nielsen et al., 1988) under the misapplied name *P. cuspidifolia* Harms. The recently described *P. ulmeri* is conspecific with *P. viridescens*. The material now at hand provides us with reason to emend Linda Escobar's description and provide some observations on its pollination biology.

Woody liana, reaching ca. 8 m, minutely pubescent to glabrescent, with subterete, striate stems to 5 cm diam. Stipules 2.5–6.0 × 1.0 mm, linear falcate; petiole 0.8–3.2 cm, striate; blade lanceolate, occasionally ovate, 6.2–14 × 2.5–8.3 cm, coriaceous, glabrous above, lightly pubescent beneath, apex 2- or 3-lobed (or occasionally unlobed), with erect triangular lobes, the lobes often unequal, normally the central lobe exceeding lateral lobes, less frequently lateral lobes longer, or lateral lobes rarely missing, lateral lobes (0–)0.1–0.5(–1.3) cm, acute apiculate; central lobe (0–)1.0–1.9 cm, acute apiculate; leaf base cordate to truncate or rounded; margin entire, slightly revolute; 4–18 laminar nectaries, ocellate, located between major veins on abaxial surface, a few occasionally located outside major veins. Peduncle 4.0–9.5 cm, paired or occasionally solitary; floral stipe 7–12 mm; bracts 3, dissitate, setaceous, 3–6 × 0.5 mm. Flowers 6.0–7.0(–10) cm diam., light green; hypanthium patelliform, 5-angular, 0.2 × 1.7–2.2 cm; sepals narrowly triangular, carinate, 2.4–3.7(–5.5) × 0.6–0.8(–1.1) cm, membranaceous to subcoriaceous, 3(–5)-nerved, green outside with white hyaline margins, light green inside; petals oblong to lanceolate, 1.5–2.8 × 0.4–0.7 cm, membranaceous, light green; corona in 1 series; outer series 7–14 × 2 mm, ligulate, thick-fleshy, with two filaments placed opposite each sepal, one opposite each petal, in open flowers usually only small remains can be found; operculum ca. 2 mm high, placed very near the limen, or the basal portion adnate to the edge of the limen (in dry open flowers it seems to originate from the limen), the margin lacerate or cleft, the free portions 0.5–1.3 mm long, the basal part not plicate; nectary apparently absent; limen annular, disk-shaped; androgynophore 0.5–0.8(–1.7) cm; ovary ellipsoid, densely pubescent, with straight tan or white trichomes ca. 0.1 mm long; styles free or united for about 0.5 mm, 6–7 mm, dark purple. Nearly mature fruits 5–6 × 2.5 cm, ellipsoid to slightly obovoid, with a broad blunt apiculate apex, lightly pubescent, green; seeds 7–8-sulcate, obovate to widely obovate, the ridges rugulose.

The description here presented deviates from the protologue in the following aspects. The plant is not a herbaceous vine, but a rather robust woody liana that occasionally completely covers midsized trees. Individual measurements have changed due to the variation found in the large amount of material seen. The shape of the leaves as well as the unlobed, bilobed, or trilobed apex shows more variation. But the most remarkable feature of this species is that in almost all open flowers the fleshy outer corona has been removed and cannot be observed. The senior author has observed that the buds all have a well-developed fleshy outer corona and a tiny non-plicate operculum adherent to the limen in buds presumed ready to flower the next day. Schwerdtfeger (1997) suggested that the corona falls off or is removed by visitors to the flower. It is significant that a nectary seems to be absent, a condition known also in the genus only in *P. xiikzodz* of Mesoamerica (MacDougal, 1992). We hypothesize that this species flowers very early in the morning and that the pollinator eats particularly the outer coronal rays while pollinating the flower. We know of no other example in the genus where floral parts other than nectar or pollen are offered as fodder for the pollinator. The mention of a 7-mm-high operculum by Escobar (1989) is an apparent typographical error: the only coronal structures on the type (operculum and remnants of corona) are 2 mm or less. The type collection seems to be an extremely large flower, in several aspects twice as large as some other collections that we refer to this species. Most fruits seen are immature, but *Gentry 74964* has a green fruit with black, mature seeds that probably is mature or nearly so. The people in the area of San Lucas, Loja, are said to eat mature fruits.

This unusual species belongs to the subgenus *Decaloba* (DC.) Reichenbach, and based on its bract morphology, position of laminar nectaries, and seed morphology, we agree with Schwerdtfeger (1997) that it belongs to section *Decaloba*. It is difficult to specify its nearest relative. It was discussed by Escobar (1989) in conjunction with *P. chelidonea* Masters, with which it has some resemblance in leaf shape. The reduced and non-plicate operculum, usually a diagnostic character at the subgenus level, is seen as an adaptation to the loss of the nectary and the peculiar adaptation to a chewing pollinator.

There is some variation in the length of the androgynophore in the material. Some specimens with long androgynophores will key in the *Flora of Ecuador* to *P. cuspidifolia* sensu Holm-Nielsen et al. (1988) (this species), but others will key to *P. lancearia* sensu Holm-Nielsen et al. (1988); see *P. smilacifolia* in this article for further discussion of differences.

Specimens examined. ECUADOR. **Azuay:** road Turi–Tarqui S of Cuenca, 2900–3000 m (fl), *G. Harling 27230* (GB not seen; photocopy, MO); eastern Cordillera, 1–8 km N of the village Sevilla de Oro, 8000–9000 ft., 27 July–12 Aug. 1945 (wilted fl), *Camp E-4343* (AAU); Km 12–15 Gualaceo–Macas road, remnants of montane forest with pastures, 3°00′S, 78°40′W, 2700–2900 m, 06 Aug. 1986

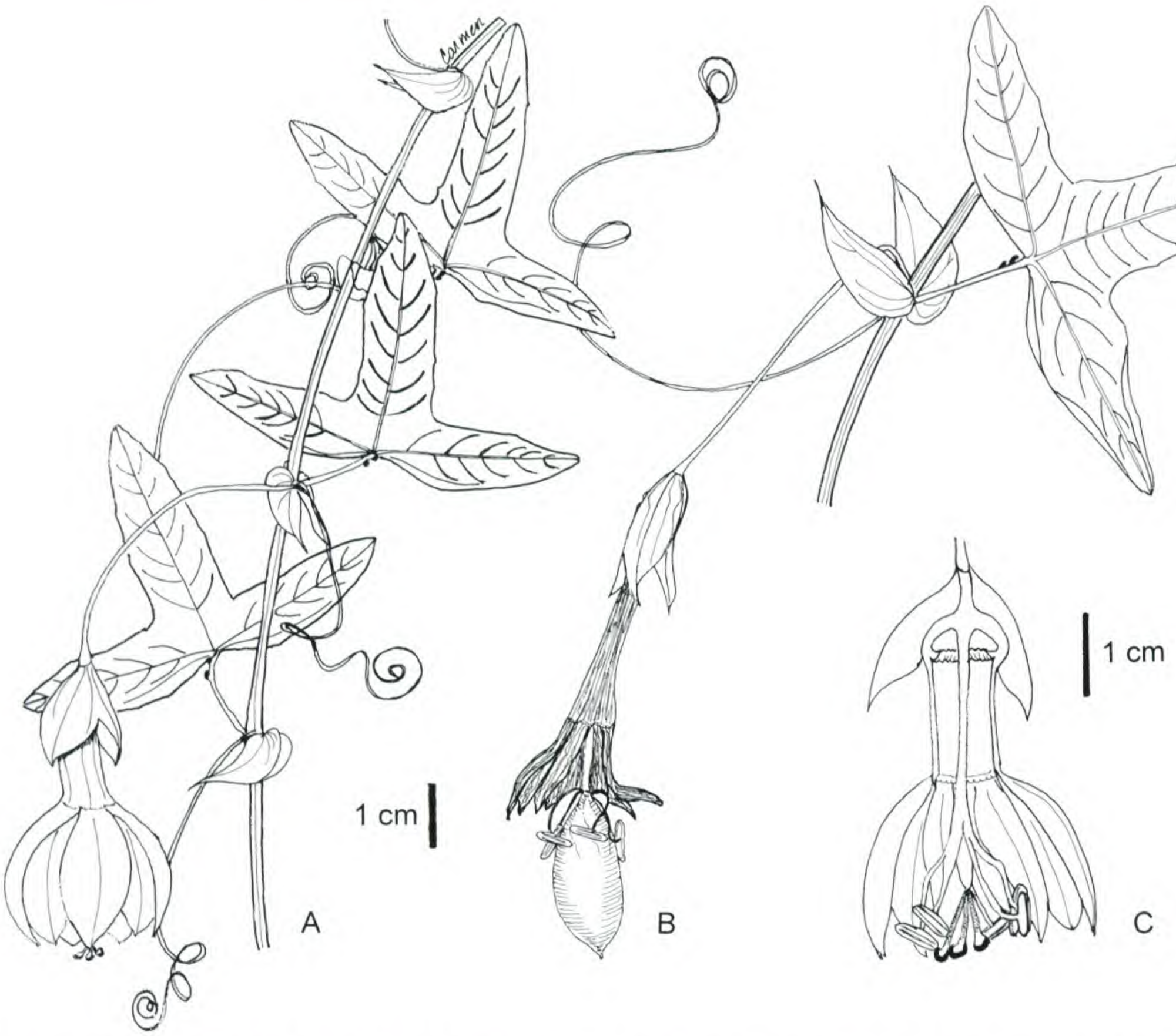

Figure 2. A–C *Passiflora luzmarina* P. Jørgensen. —A. Habit with flower. —B. Young fruit. —C. Flower. (A & C, *Cueva 516*; B, *Cueva 510*).

(fl, fr), *P. Jørgensen 61406* (AAU, MO, QCA, QCNE); Nudo de Portete, pass between headwaters of the ríos Tarqui (Atlantic) and Girón (Pacific), ca. 9000 ft., 10 Mar. 1945 (bud), *Camp E-2152* (NY); bosque del río Mazán al occidente de Cuenca, faldas del Cajas, 3050–3100 m, 17 Aug. 1987 (fr), *Mena 867* (NY, QCA). **Bolívar:** second stop along rd. above Chazo Juan, toward Echiandia, Ventanas–Salinas Rd., 1435 m, 3 Nov. 1992 (sterile), *D. Kappan 30* (TEX); small patches in disturbed cloud forest, rather dry, along first 15 km of road Chillanes–El Tambo, 2400 m, 18 July 1991 (fl), *van der Werff et al. 12464* (MO). **Chimborazo:** cañon of the Río Chanchan, about 5 km N of Huigra, 5000–6500 ft., 19–28 May 1945 (fl), *Camp E-3399p.p.* (NY); above Pallatanga, towards San Juan and Llimbe, 1°55′S, 79°03′W, 2300–2750 m, 25 Feb. 1987 (bud), *P. Jørgensen 61709* (QCA). **Cotopaxi:** Latacunga–Pilaló road, E of Pilaló, 0°58′S, 78°58′W, 2900 m, 10 Nov. 1984 (sterile), *P. Jørgensen & Brandbyge 56317* (AAU cultivated at AAU; QCA, QCNE from wild); Zumbagua–Pilaló, roadside, 0°57′S, 78°59′W, 2750–3050 m, 18 Feb. 1991 (bud), *P. Jørgensen et al. 93008* (AAU, MO, QCA). **Loja:** Loja–Zamora, km 11, 3°59′S, 79°11′W, 2630 m, 23 Feb. 1988 (sterile), *P. Jørgensen 65082* (AAU, QCA); San Lucas–Saraguro, km 2, roadside, 3°42′S, 79°15′W, 3300 m, 16 Nov. 1990 (fl, fr), *P. Jørgensen et al. 92728* (AAU, MO, QCA, QCNE); Guachanamá–Cerro Guachaurcu, km 0–6, secondary forest and shrubby páramo, 4°02′S, 79°52′W, 2800–3050 m, 25 July 1990 (fl), *P. Jørgensen et al. 92143* (AAU, MO, QCA, QCNE); Cerro de Celica, Celica–Guachanamá, past Guachanamá close to the antenna, 4°02′12″S, 79°52′14″W, 3090 m, 13 Apr. 1994 (fl), *P. Jørgensen et al. 133* (AAU, LOJA, MEXU, MO, NY, QCA, QCNE); Cerro Villonaco, Loja–La Toma, km 13, turnoff towards Chuquiribamba, km 2, at Hcda. Huangora, 3°56′52″S, 79°15′52″W, 2640 m, 18 Apr. 1994 (fl), *P. Jørgensen et al.* 376 (LOJA, MO, QCA, QCNE); Loja–Saraguro, km 25, forest remnants, 3°51′39″S, 79°16′52″W, 1730 m, 22 Apr. 1994 (fl), *P. Jørgensen et al. 519* (AAU, GB, LOJA, MEXU, MO, NY, QCA, QCNE). **Pichincha:** Cantón Quito, Carretera Chillogallo–Chiriboga, faldas del volcán Pichincha, 0°20′S, 78°45′W, 2500 m, 20 Feb. 1992 (sterile), *D. Rubio et al. 2426* (MO).

PERU. **Piura:** Cerro Aypate, 49 km E of Ayabaca, 4°35′S, 79°32′W, 2730 m, 22 Sep. 1991 (fr), *A. Gentry et al. 74964* (MO). **Amazonas:** Prov. Chachapoyas, 22 km from Leimebamba on road to Balsas, 6°45′S, 77°48′W, ca. 3000 m, (fl), *B. A. Stein & Todzia 2083* (holotype, MO); Chachapoyas–Celendín road, between Leymebamba and Calla-Calla, heavily damaged high montane forest, 6°45′S, 77°49′W, 3200 m, 27 May 1984 (fl), *D. N. Smith & J. Cabanillas 7204* (MO); Leimebamba, low forest, 2400 m, 29 Dec. 1962 (fl, imm. fr), *F. Woytkowski 7832* (MO(2)). **Cajamarca:** Prov. Cotumazá, Bosque de Cachil, 2500 m, 29 July 1993 (fl), *A. Sagástegui et al. 15006* (MO). **Piura:** Cerro Aypate, 49 km E of Ayabaca, lower slopes, 2120–2300 m, 4°35′S, 79°32′W, 24 Sep. 1991 (fl), *A. H. Gentry*

Table 2. Comparison of *Passiflora luzmarina* to subgenus *Tacsonia* species with short hypanthiums and *P. cumbalensis*.

Character/Species	*P. cumbalensis*	*P. linda*	*P. glaberrima*	*P. brachyantha*	*P. luzmarina*
Leaf	Simple trilobed	Compound trifoliate	Simple trilobed	Simple trilobed	Simple trilobed
Length of peduncle in cm	3.0–10.5	13–15	1.0–2.5	2.7–3.4	4.8–5.5
Length of hypanthium in cm	5.3–12.7	1.5–3.1	2.5–3.9	3.9–4.0	2.0–2.3
Leaf size in cm	2.6–14.5 × 3.5–16.3	2.5–10 × 7.8–13	2.4–5.2 × 4.4–4.2	3.5–7.3 × 4.4–11.0	3.4–5.9 × 5.7–8.6
Lower leaf surface	Glabrous to densely pubescent	Moderately strigose	Glabrous (occasionally sparsely pubescent)	Pubescent	Glabrous
Hypanthium length in cm	5.3–12.7	1.5–3.1	2.5–3.9	3.9–4.0	2.0–2.3
Hypanthium base	Slightly dilated	Dilated	Not dilated	Dilated	Dilated
Hypanthium outside	Glabrous	Glabrous	Pubescent	Pubescent	Glabrous

et al. 75046 (MO(2)). **Lambayeque:** Prov. Ferreñafe, Bosque de Chiñama, 2500–2600 m, 23 Aug. 1988 (imm. fr), *A. Cano 2085* (MO).

Passiflora luzmarina P. Jørgensen, sp. nov. TYPE: Ecuador. Loja: Cantón Loja, Uritusinga, camino a La Argentina, 200 m antes de La Argentina, Cerco de potrero, 4°05′15″S, 79°15′00″W, 2450 m, 10 Nov. 1995 (fl), *E. Cueva 516* (holotype, MO). Figure 2.

A *Passiflora brachyantha* L. K. Escobar caulibus foliis bracteis et hypanthio glabris, differt.

Vine, glabrous except puberulent inside margin of the bracts; stem terete to angular, striate. Stipules (0.7–)1.2–1.7(–2.7) × 0.3–0.6(–1.0) cm, reniform, apex acuminate to aristate, margin entire or with a few serrate glandular teeth, glaucous green or green; petiole 1.2–2.5 cm, dark, with (2–)4(–5) stipitate glands, one pair of glands located very close to the blade base, the second pair 3–5 mm from the blade base; leaf blade 2.8–7.4(–11.7) × 5.2–11.2(–20.0) cm, deltate, incised ⅔–⅘ of the length, three-lobed, lobes linear-lanceolate to lanceolate to ovate, 0.6–3.4 cm wide, lobe apices acute, apiculate, angle between lobes 80°–120°; base slightly cordate to deeply cordate; margin entire (with a few glandular-serrate teeth along the basal margin of the side lobes) to serrate; upper leaf surface green with light green impressed principal nerves; lower surface glaucous green, principal nerves prominent, dark. Peduncle 2.5–5.5 cm, solitary, very slender, pendent; bracts connate for ½ forming a campanulate structure 1.6–2.8 × 1.3–1.4 cm, each bract elliptic, margin entire, apex acute, puberulent along inside margin, indument in a 1.5–2.0-mm zone along margin. Flowers 3.5–4.0 cm diam., glabrous; hypanthium 2.0–4.3 × 0.5–0.7 cm, the base truncate and dilated, otherwise cylindric, light pink to light purple outside, white inside; sepals 2.2–2.7 × 1.0–1.2 cm, oblong, acute, carinate, aristate, awn 0.5–1 mm, light pink to light purple; petals 1.8–2.6 × 0.4–0.9 cm, linear, obtuse to truncate, narrowed at base, light pink to light purple; corona uniseriate, reduced to a purple ring at mouth of hypanthium with white teeth; operculum straight, pointing downward at a 25° angle, margin dentate, white; androgynophore 2.7–5.0 cm; ovary 5–6 mm, ellipsoid, glabrous; styles 4–8 mm, light green; stigma 2 mm diam., capitulate, whitish green. Mature fruit orange red, 4.0–7.2 × 2.5 cm; seeds obovoid, 5–6 × 3–5 mm, dark brown, pitted to the margin.

This gracile new species is known from nine collections from about 2500 m elevation on the Pacif-

ic-facing slopes of Cerro Villonaco and Uritusinga. These localities lie just above the acacia-forests, which have their uppermost distribution at about 2400 m elevation in the Catamayo valley. The forest remnants that house this species are few and under considerable pressure. However, most *Passiflora* species can survive in hedges as indicated by the type collection. The locality of *Jørgensen et al. 51* was burned in 1995, and it is uncertain whether this species will survive burning.

Passiflora luzmarina is named after the senior author's niece Luz Marina Unda, who is both tiny and very beautiful. This species has the second-smallest flowers within the subgenus *Tacsonia*, only matched by *P. gracilens*. It is probably most closely related to *P. cumbalensis* with which it shares its pendent light pink to light purple flowers on a delicate long peduncle. The length of the peduncle varies: when flowering at the tip of a pendent shoot peduncles are short, while when flowering below, on horizontal shoots, peduncles are longer. It also resembles *P. glaberrima* from further south, but is distinguished by the longer and more slender peduncles, and by being completely glabrous. Escobar (1992) described *P. brachyantha* from a collection that was collected only a few kilometers from the localities where *P. luzmarina* has been found. These two species can be distinguished by the almost complete lack of indument in *P. luzmarina* versus pubescent stems, bracts, lower leaf surface, and stipules in *P. brachyantha*. For further characters to separate the species see Table 2. Escobar (1992) attributed the speciation of short-tubed tacsonias "to the selective pressure exerted by their pollinators." It is remarkable that the number of short-tubed species of subgenus *Tacsonia* known in southern Ecuador and northern Peru has more than doubled in the past 10 years.

Paratypes. ECUADOR. **Loja:** Cantón Loja, Uritusinga, La Argentina, camino a Bellavista, matorral en cerco, 4°05′50″S, 79°15′20″W, 2500 m, 7 Oct. 1995 (fr), *E. Cueva 510* (MO); Uritusinga, camino a La Argentina, 200 m antes de La Argentina, 4°05′15″S, 79°15′00″W, 2450 m, 7 Mar. 1997 (fl & fr), *E. Cueva 929* (MO); (fl), *E. Cueva 929B* (MO); 19 Apr 1997 (fl), *V. van den Eynden & E. Cueva 991* (MO); (fr), *V. van den Eynden & E. Cueva 992* (MO); (fl), *V. van den Eynden & E. Cueva 993* (MO); (immature fr), *V. van den Eynden & E. Cueva 994* (MO); Cerro Villonaco, old road Loja–Pedestal–La Toma, km 11.9, turnoff to the left [South], km 0.5, 2550 m, 4°00′53″S, 79°15′10″W, 10 Apr. 1994 (fl), *P. Jørgensen et al. 51* (MO, QCNE).

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A New Species of *Xerophyta* (Velloziaceae) from Madagascar

Gordon McPherson, Henk van der Werff, and Richard C. Keating
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. *Xerophyta connata*, a distinctive new species from the mountainous northwest of Madagascar, is described and illustrated. Its morphology and anatomy are compared to those of other members of the Velloziaceae.

Among recent collections from the Manongarivo Massif in northwestern Madagascar are specimens of an undescribed member of the Velloziaceae found covering sandstone outcrops along a small river.

Xerophyta connata McPherson & van der Werff, sp. nov. TYPE: Madagascar. Antsiranana: Manongarivo Massif, E of Ankaramy, 1100 m, 14°05′S, 48°20′E, 16 Oct. 1994, *McPherson & van der Werff 16374* (holotype, MO; isotype, TAN). Figure 1.

Species madagascariensis septentrionalis antheris connatis corona evidenti inflorescentia glabra eglandulata facile distinguenda.

Plants sprawling, branched, forming a loose, tufted mat, the erect portions of the stem up to ca. 20 cm high (excluding flowers). Branches ca. 1 cm diam. at the level of the intact leaf bases, the lower portions covered by old, frayed, fibrous leaf bases. Leaves of flowering branches 8–14 cm long, 3–8 mm wide, apex acute, a curved line of disarticulation usually evident near the base, both surfaces and the margins sparsely pubescent, the pubescence somewhat scale-like at first, eventually becoming more hair-like, margin thickened and minutely denticulate, at least distally, each tooth capped by a hair or the remnants of one. Flowers 1–2(–3) together, arising from the rosette of leaves terminating each branch; pedicels 17–27 cm long, ca. 1.5 mm diam., glabrous. Perianth rotate, pink-purple with yellow at throat, deeply lobed, the hypanthial tube ca. 2 mm long, glabrous, the tepals acute, glabrous, conspicuously veined, the outer ones 18–32 mm long, 4–8 mm wide, the inner ones 19–28 mm long, 7–10.5 mm wide; corona 14–20-lobed, minutely papillose, the lobes 1–1.5 mm long, fused basally, 0.5–1.5 mm wide, obtuse or acute-acuminate apically, inserted at the rim of the hypanthial tube; stamens 6, the filaments 1–1.3 mm long, narrowly winged and somewhat flattened, inserted slightly below the rim of the hypanthial tube and below the coronal lobes, reflexed (i.e., sloping downward into the hypanthial tube), free from one another, sub-basifixed (i.e., each filament attached to the abaxial surface of an anther very near its base but the fused anther sacs extending ca. 0.5 mm below the attachment point); anthers erect, 9–13 mm long, those opposite the outer perianth members extending 1–1.5 mm further than the others, introrse, connate into a tubular structure 3–4 mm diam.; ovary 4–5 mm long, ca. 4 mm diam., terete, glabrous, 3-locular, multiovulate; style 15–21 mm long, ca. 0.5 mm diam., the terminal 1.5–3 mm slightly thicker than the lower portion and bearing three elongate stigmatic regions; fruit unknown.

At the time it was collected, this plant was assumed to belong to the genus *Xerophyta*, the only genus of Velloziaceae reported from the island (Perrier, 1950) and one represented by many species on mainland Africa (Smith & Ayensu, 1975). Closer study revealed that the new species possesses two features that distance it somewhat from typical members of that genus. First, the anthers of the recently collected species are connate into a narrow tube, a condition apparently elsewhere unknown within the family. Second, the perianth tube bears an evident corona (sensu Jackson, 1971: "any body which intervenes between the corolla and stamens"), in this case, a lobed ring of thickened tissue at the rim of the hypanthial tube, and thus between the tepals and the stamens. Well-developed coronas had hitherto been attributed to the Brazilian genus *Barbacenia* and its close relatives but to no Old World members of this family (Perrier, 1946; Smith & Ayensu, 1976; Menezes, 1980a). In fact, the absence of a corona is given by Menezes (1980a) as one of the two features defining her version of the subfamily Vellozioideae (the other feature, that of having a single leaf vascular bundle sheath, is discussed below), which includes *Xerophyta*. However, in at least such *Xerophyta* species as *X. splendens* (Rendle) N. L. Menezes, there exist structures that may be homologous to the coronal lobes of the Madagascan collection. These ligules

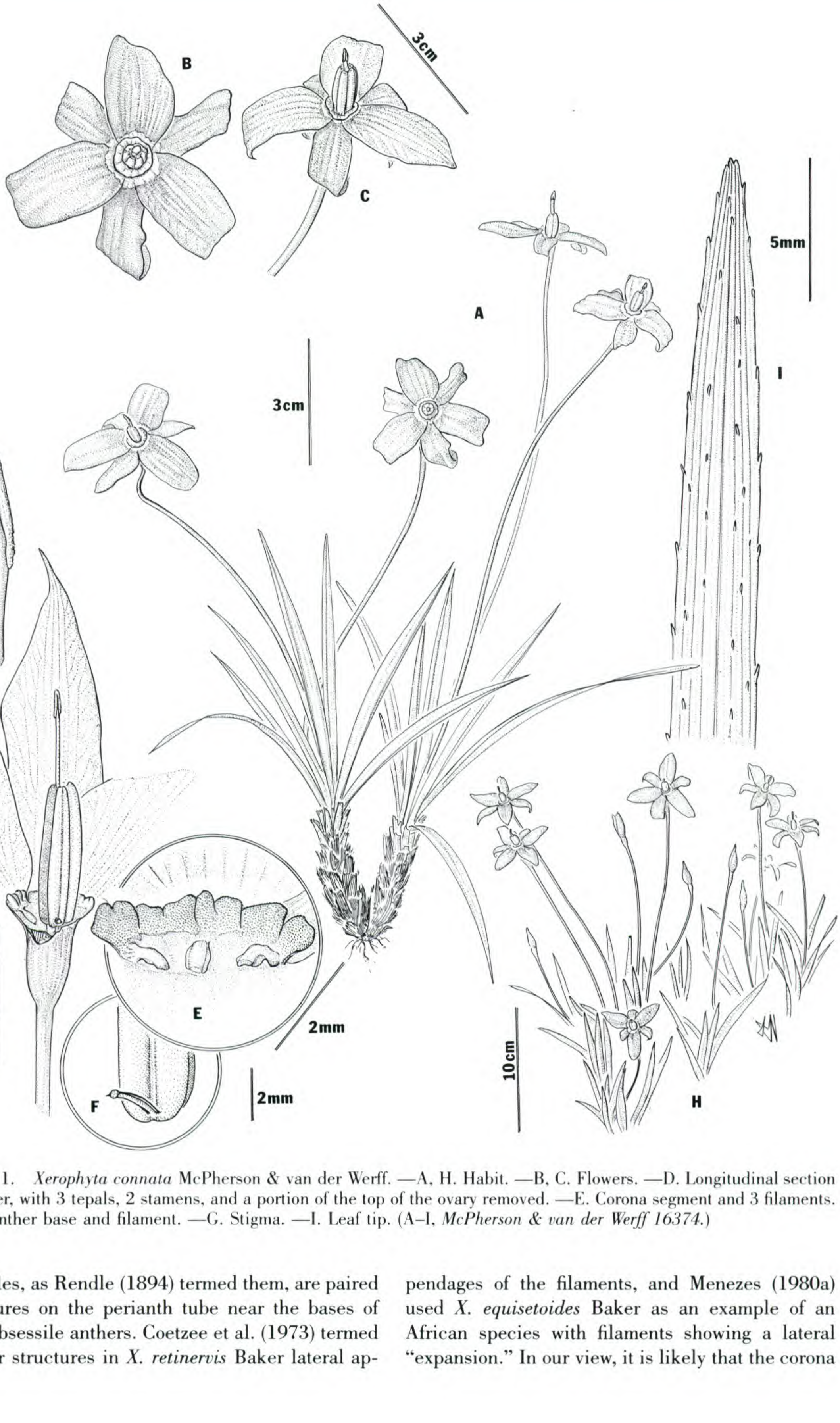


Figure 1. *Xerophyta connata* McPherson & van der Werff. —A, H. Habit. —B, C. Flowers. —D. Longitudinal section of flower, with 3 tepals, 2 stamens, and a portion of the top of the ovary removed. —E. Corona segment and 3 filaments. —F. Anther base and filament. —G. Stigma. —I. Leaf tip. (A–I, *McPherson & van der Werff 16374.*)

or scales, as Rendle (1894) termed them, are paired structures on the perianth tube near the bases of the subsessile anthers. Coetzee et al. (1973) termed similar structures in *X. retinervis* Baker lateral appendages of the filaments, and Menezes (1980a) used *X. equisetoides* Baker as an example of an African species with filaments showing a lateral "expansion." In our view, it is likely that the corona

Table 1. Selected characters of the three large genera in Velloziaceae. Morphological and anatomical data are based on both first-hand observations and inferences from the literature.

	Vellozia	*Barbacenia*	*Xerophyta*	*X. connata*
Distribution	New World	New World	Africa, Madagascar, Arabian Peninsula	Madagascar
Stamen number	(6-)9–ca. 75	6	6	6
Connate anthers	absent	absent	absent	present
Corona	absent	present	absent (1)	present
Stigma	3-lobed, capitate, peltate	capitate, small or cylindrical	cylindrical	cylindrical
Vascular bundles transcurrent	no, yes ↓ ↓	yes	yes, no ↓ ↓	yes
Adaxial sheath extension	yes, n/a	n/a	n/a, yes	n/a
Leaf bundle sheath	single	double	single or double	single
Thickened inner walls of sheath (2)	yes	no	no	no
Abaxial midvein sclerenchyma	flat, broad	thick, U-, C-shaped	flat, broad, small	flat, broad
Additional sclerenchyma	absent or strands	absent or strands	bands or strands	bands

(1) or rudimentary, see discussion.
(2) i.e., lignified vascular bundle sheath cells adjacent to phloem.

of *X. connata*, although inserted on the hypanthial tube somewhat more distally, as well as being more evenly continuous and consisting of more numerous and thicker lobes, has its evolutionary origin in structures of this kind. Its possible homology with the vascularized corona of *Barbacenia* (Menezes, 1973) remains to be determined. To conform with the recent cladistic analysis of the family (Menezes et al., 1994), the corona of *X. connata* would have to be regarded as an independent evolutionary development.

Generic limits in the family have been variously interpreted (Baker, 1875; Greves, 1921; Ayensu, 1969, 1973; Smith & Ayensu, 1974, 1976; Menezes, 1980a, b; Mello-Silva, 1991a, b; Menezes et al., 1994). Our own study leads us to agree with the view of the last-mentioned authors. Table 1 outlines the characters that led us to our generic placement for the new taxon.

Anatomy of *Xerophyta connata*

Because leaf anatomical features have been used extensively in the classification of Velloziaceae (e.g., Ayensu, 1969; Menezes, 1980a), we surveyed species in several genera in order to gain insight into the relationships of *X. connata*. The results of this survey are presented in Table 2. Comments on the most informative characters are included in the discussion of leaf anatomical character states. In the Velloziaceae, features of leaf cross-sectional anatomy are quite distinctive, often down to the species level (Ayensu, 1974). Following a description of the features of the new taxon, *X. connata*, we then attempt to determine its closest fit among the family's three largest genera.

MATERIALS AND METHODS

Dried material was available for *X. connata* and for 14 selected specimens representing other genera of the family (Appendix). Leaf specimens were restored with equal success using 5% ammonium hydroxide (Venning, 1954) or Photoflo 200/ water (1:3) (Valdes-Reyna & Hatch, 1995). Hand cross sections were made and stained two ways: in iodine-potassium iodide (1:10) and in the metachromatic dye cresyl violet acetate. Sections were placed in 30% calcium chloride, a differentiating mounting medium with a high refractive index (Keating, 1996).

OBSERVATIONS

Leaf Transverse Section. Profile: lamina flat, bent adaxially, acutely or obtusely at a small midvein. Structure: weakly dorsiventral. Thickness: 350–400 μm. Transcurrent vascular bundles regularly spaced, alternating with sets of aligned abaxial and adaxial grooves (Fig. 2B, C). Groove depth 10–30% of leaf thickness. Cuticle: birefringent, thick, smooth, following contours of the epidermal cells.

Table 2. *Xerophyta connata* and selected other specimens of Velloziaceae: leaf anatomy.

	Adax/abax grooves	Bundles trans-current	Adax sheath exten-sions	No. phloem strands	Leaf bundle sheath	Abaxial midvein sclerenchyma	Additional sclerenchyma
X. connata	opposite	yes	n/a	1	single	flat, wing	bands
X. suaveolens	opposite	yes	n/a	1	single	flat, wing	bnd, strn
X. sp.	opposite	yes	n/a	1	single	winged	bnd, strn
X. equisetoides	opposite	yes	n/a	1–7	(3)	?	bands
X. dasylirioides	alternate	no	yes	1–2	(5)	flat, wing	bands
X. eglandulosa	abax only	no	yes	2	(5)	flat, wing	bnd, strn
X. pinifolia	alternate	no	no	2	(5)	sm, thick U	bands
X. scabrida	abax only	no	yes	2	single	flat, wing, F	strands
Talbotia	none	no	no	2	single	thick U	no
Barbacenia glauca	none	yes	n/a	1	double	thick V, F	no
B. stenophylla	none	yes	n/a	1	double	semicirc	no
Barbaceniopsis	opposite	yes	n/a	2	(5)	sm semicirc	no
Vellozia glauca	abax only	no	yes	2	single (4)	flat, wing	strands
V. ornata	none	no	yes	2	single (4)	flat, wing	no
Nanuza	none (1)	yes (2)	n/a	2	(5)	round	bands

(1) Leaves are plicate. (2) Large bundles beneath abaxial ridges are transcurrent, other lamina bundles small, immersed. (3) Phloem partially and not consistently separated from outer sheath. (4) The single bundle sheath has lignified inner walls opposite phloem. (5) Phloem separated from outer sheath. Abbreviations: abax = abaxial side, adax = adaxial side, bnd = flat band, F = flanges, n/a = not applicable, scl = sclerenchyma, semicirc = semicircular, sm = small, strn = rounded strand, U = U-shaped, V = V-shaped.

Epidermis: cells small, cuboidal in transverse section. Stomata: on sides of abaxial grooves. Mesophyll: weak tendency toward differentiation into short palisade cells adaxially, and horizontally elongated cells abaxially (Fig. 2B, C). Air space: about 2% in spongy mesophyll. Midrib bundle very small. Laminar vascular bundles: parallel and evenly spaced, each surrounded by a single parenchymatous sheath. Xylem: a shallow or deep V with large median tracheid and several smaller ones on each side. In center of V, a 3rd vertical strand comprised of few tracheary cells occurs, as in leaves of most other genera examined. Phloem: a single U-shaped strand abaxial to the xylem (Fig. 2B, C). Sclerenchyma: fiber caps over both phloem and xylem together form a transcurrent girder, separated from the epidermal layers only by a single-layered, parenchymatous bundle sheath (Fig. 2B, C). The abaxial cap, Y-shaped on phloem side, extends with straight sides to abaxial epidermis. The adaxial (xylem) cap is an inverted Y facing xylem, extending as a centrally constricted column to the adaxial epidermis. Midvein fibers form a very small adaxial xylem cap. Abaxially, fibers form a broad band or wing, several cells deep and 3–4 vein widths laterally on each side, adjacent to the abaxial hypodermis (Fig. 2A). No flanges extend in an adaxial direction lateral to the midvein. The band is somewhat thicker in the center than laterally. In lamina, additional fibers form subepidermal bands, 1–2 cells deep on either side of bundles, extending to edge of grooves on both surfaces (Fig. 2C). Margin: blunt V-shape with apex pointing abaxially. Triangular marginal sclerenchyma present beneath hypoderm. Leaf sheath: surface grooves absent. Non-functional mesophyll becomes large aerenchyma spaces between bundles.

DISCUSSION OF LEAF ANATOMICAL CHARACTER STATES

Grooves. These are usually deep, parallel with the linear axis of the leaf (parallel with vascular bundles), and usually occupying 10–30% of the leaf thickness. Grooves are on abaxial surface (Fig. 2D) or on both surfaces when present. Whether they are opposite or alternate along the adaxial and abaxial surfaces appears to be species specific. One surface may have grooves of a greater frequency than the other surface.

Fibrovascular bundles. Fiber strand (bundle cap) types were defined for Cyperaceae by Metcalfe and Gregory (1964) in a way that is readily adaptable to Velloziaceae as well. For lamina bundles (with the adaxial side oriented up), sclerenchyma (fiber) patterns as seen in cross section are referred to by these authors as "Y-shaped" (inverted) on the adaxial side and as "Y-shaped girders" on the ab-

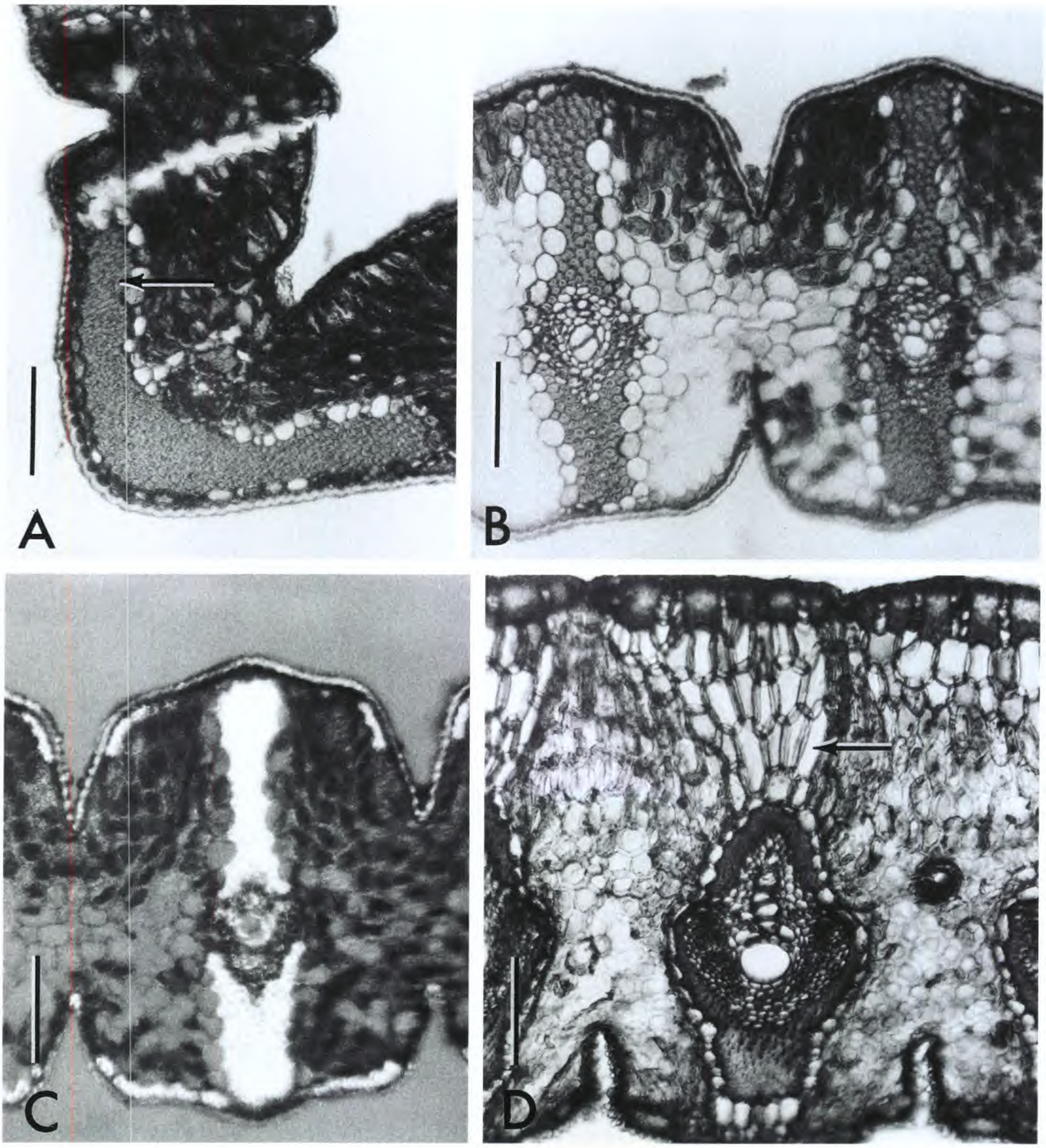
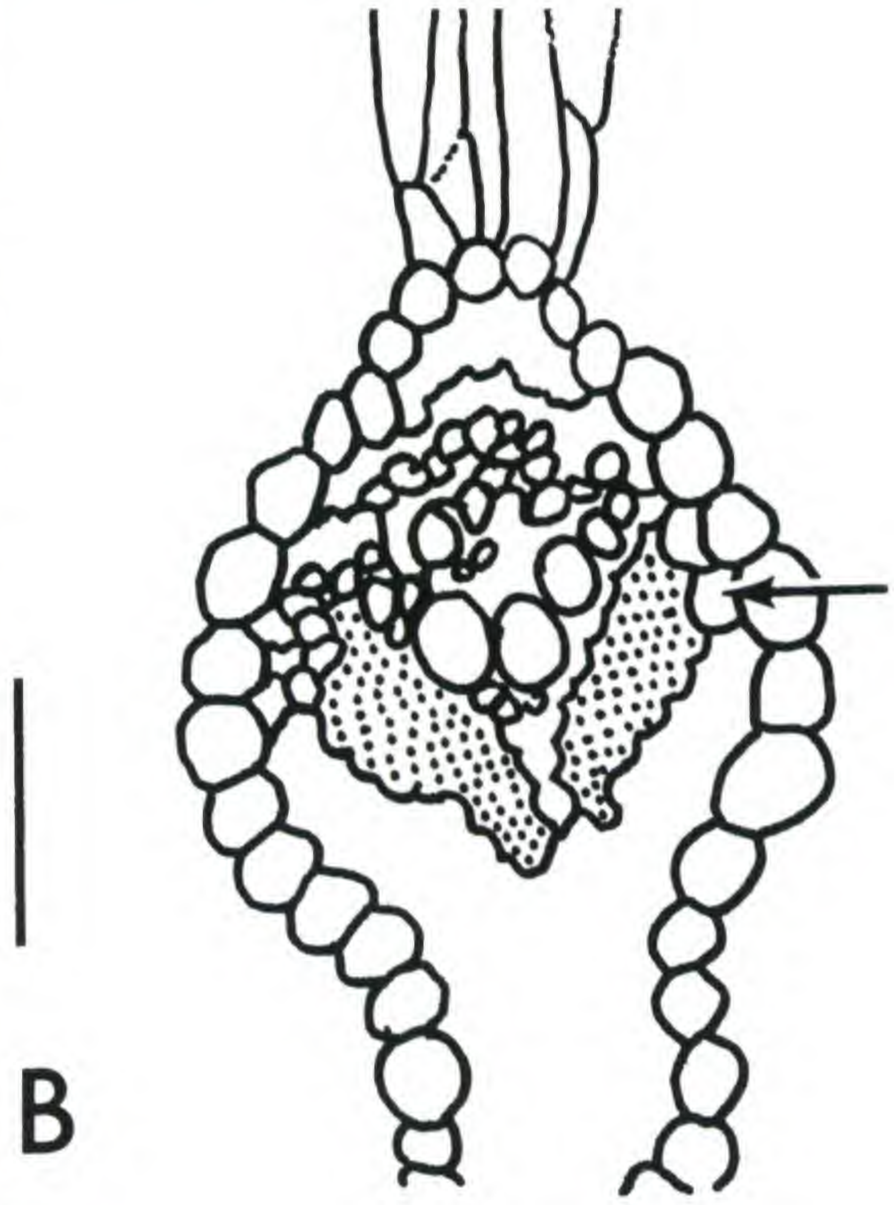
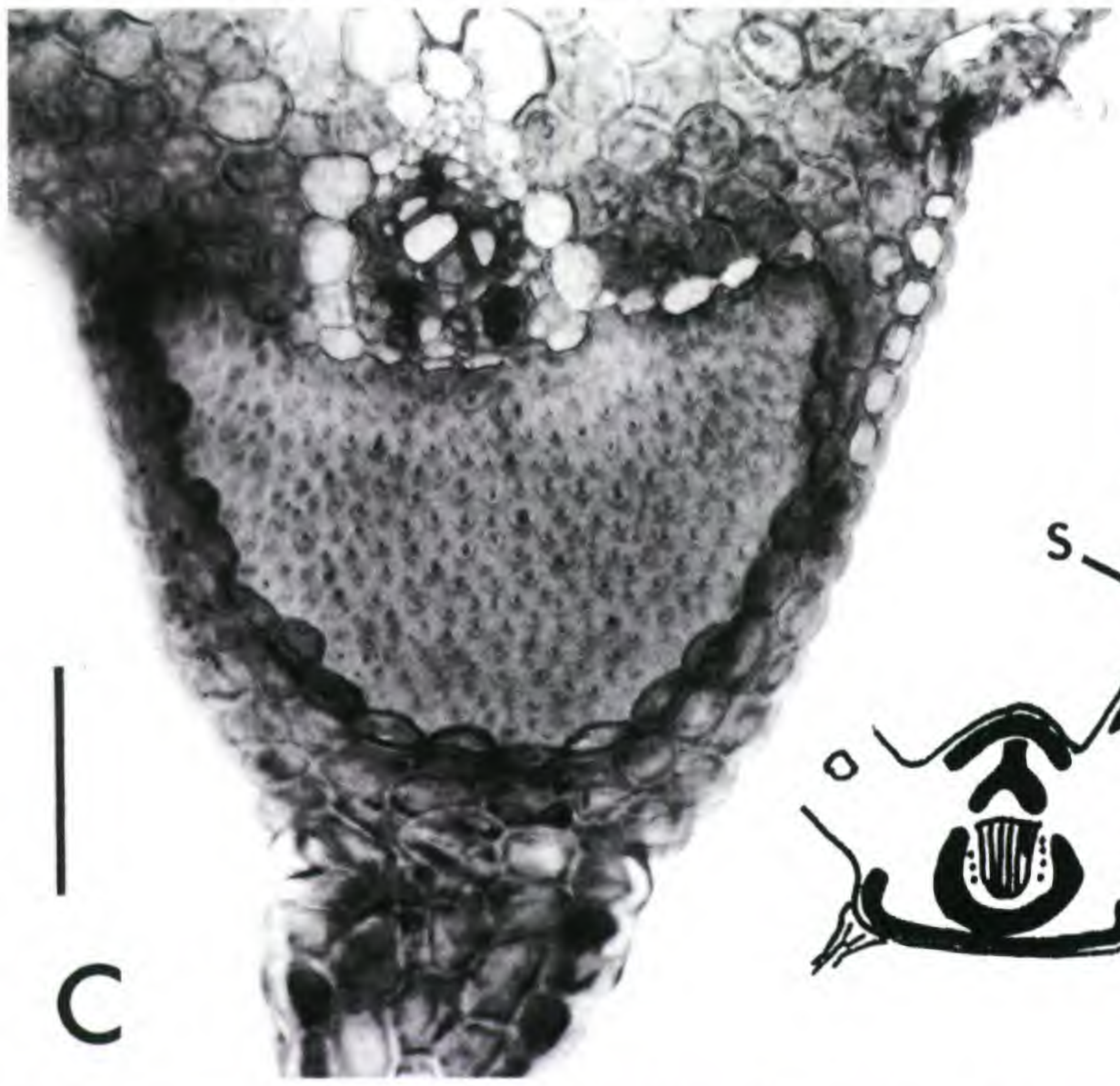


Figure 2. —A. *Xerophyta connata.* Midvein showing flat winged abaxial sclerenchyma strand (arrow). —B. *X. connata.* Non-polarized view of leaf lamina showing single sheath surrounding vascular bundle and adaxial palisade tissue. —C. *X. connata.* Polarized view showing transcurrent sclerenchyma. Note additional subepidermal strands of sclerenchyma beneath both surfaces. —D. *Vellozia glauca* Pohl. Note absence of adaxial grooves in lamina and non-transcurrent vascular bundle. Adaxial sheath extension between vascular bundle sclerenchyma and epidermis formed of a palisade-like, parenchymatous sheath extension (arrow). (A–C, *McPherson & van der Werff 16374*; D, *Irwin 21395.*) Scale lines A–D = 100 μm.

axial side. Together, the two distinctively shaped abaxial and adaxial fiber caps cover the xylem and phloem, forming the characteristic fibrovascular bundle complex in Velloziaceae.

In many specimens examined, fibrovascular bundles are surrounded by single-layered parenchymatous sheaths. In species with transcurrent fibrovascular bundles, the fiber caps extend close to the two epidermal layers, separated from them by only a uniseriate parenchymatous sheath (Fig. 2B, C). In non-transcurrent leaves, much of the lamina tissue adaxial to the vascular bundles is occupied by one or more tiers of aquiferous parenchyma (palisade-shaped cells) rather than by lignified fibrous tissue (Menezes, 1971). These elongated cells, without contents in restored tissue, appear to be extensions





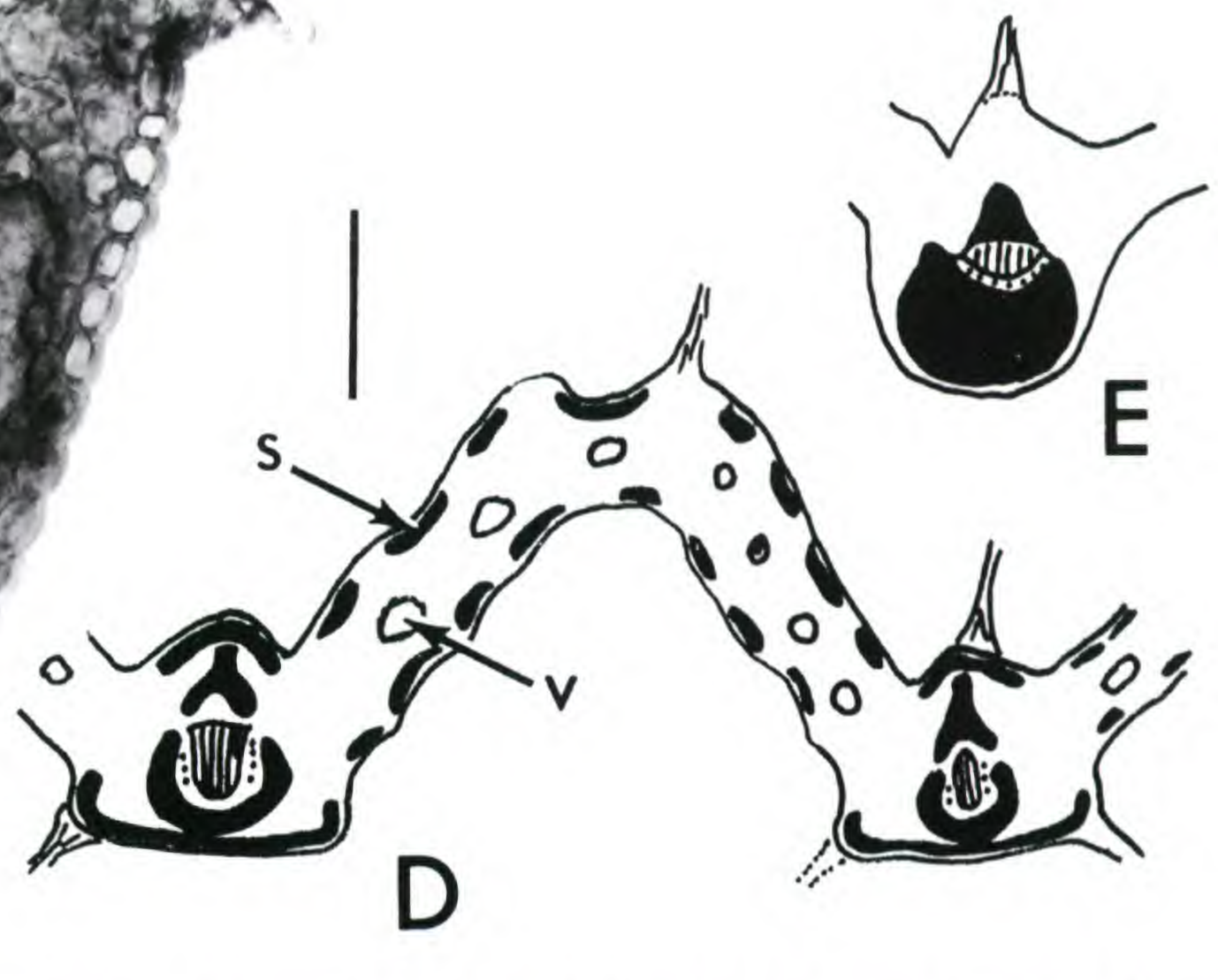


Figure 3. —A, B. *Xerophyta eglandulosa* H. Perrier. Non-transcurrent vascular bundle with parenchymatous adaxial bundle sheath extension. Cells separating phloem from bundle sheath indicated by arrow. Stippled areas represent phloem. —C. *Barbacenia stenophylla* Goethart & Henrard. Midrib showing semicircular abaxial bundle cap. —D. *Nanuza plicata* (Martius) L. B. Smith & Ayensu. Lamina cross section showing plicate structure, small laminar vascular bundles (arrow v) and subepidermal sclerenchyma (arrow s). —E. *N. plicata* midrib. Note large semicircular abaxial sclerenchyma strand. (A, B, *McPherson & van der Werff 16459*; C, *Irwin et al. 9901*; D, *Davidse et al. 11823.*) Scale lines A–C = 100 μm, D–E = 200 μm.

of the adaxial portion of the vascular bundle sheath. Beneath these parenchymatous sheaths, adaxial lignified sheath tissue is always present, forming distinctive, but smaller, adaxial bundle caps (Fig. 2D).

Midvein fibrovascular bundle. The midvein xylem and phloem strands are usually smaller than those of the main lamina veins. The sclerenchyma pattern is not usually transcurrent and is always distinguished from that of the laminar bundles. Being much better developed on the abaxial side of the vascular bundle, the sclerenchyma usually brackets the xylem and phloem. Species with flat or tapered winged abaxial sclerenchyma bands (Fig. 2A; Table 2) do not intergrade with those with thick U-shapes (crescentiform) or semicircles (Fig. 3C, E).

Additional sclerenchyma. While in some genera or species, groups of fibers may occur only as xylem and phloem caps, others have additional subepidermal bands or rounded strands (Figs. 2C, 3D). These occur in several patterns beneath one or both surfaces.

Xylem and phloem. In Velloziaceae these tissues form a pattern most closely resembling type II bundles as defined for monocots by Cheadle and Uhl (1948). The xylem strand usually forms a V- or W-shaped structure. Abaxial to the xylem, the phloem may form a single cup-shaped strand, two distinct elliptic strands, or be cup-shaped but separated by 4–6 uniseriate, lignified partitions. This forms 5–7 functionally discrete phloem strands, although their degree of anastomosing has not been investigated.

Double bundle sheath. In single-sheathed vascular bundles (as in *Vellozia*), the parenchyma sheath is usually a single layer surrounding the entire bundle. At their most lateral extent, the xylem and phloem strands usually come in contact with this sheath. In double-sheathed vascular bundles (as in *Barbacenia*), an additional layer separates the xylem and phloem from contact with the outer main sheath (Menezes, 1980a). Menezes (1980a) used this character and a morphological character (presence of a corona, see above) to divide the family into two subfamilies, and characterized *Xerophyta* as having a single bundle sheath. However, in at least 3 of the 8 species of *Xerophyta* examined in the present study (Table 2; Fig. 3A, B) the phloem is separated from the outer sheath by what appear to be extensions of recurved xylem.

Relationships

Xerophyta connata differs in nearly all character states listed in Table 2 from *Vellozia.* The two have in common only the single leaf bundle sheath (partially lignified in *Vellozia*) and a flat broad midrib sclerenchyma.

Similarly, *Xerophyta connata* has little in common with *Barbacenia.* They share transcurrent vascular bundles, one phloem strand, as well as the absence of thickened inner sheath walls. These two taxa are distinguished by the presence of a double bundle sheath in *Barbacenia* and differing patterns of midvein sclerenchyma. Also, almost all *Barbacenia* species have no sclerenchyma in addition to the bundle caps (Smith & Ayensu, 1976; Mello-Silva, 1995).

While the surveyed species of *Vellozia* and *Barbacenia* have very different lists of character states, the variation we found within *Xerophyta* broadly overlaps the character states of the other two genera (Table 2). Virtually all of the new taxon's anatomical character states are present in one or another species of *Xerophyta.* These include opposite grooves on the lamina, transcurrent bundles, some species with one phloem strand, a single bundle sheath, midvein sclerenchyma flat, winged, and possession of additional sclerenchyma as subepidermal bands. Hence the anatomical evidence supports our generic placement of the new taxon.

Anatomically, *Xerophyta connata* most closely resembles *X. equisetioides, X. suaveolens,* and *X. sp.* (Table 2). Of these three, the latter two seem closest on the basis of leaf anatomical evidence.

Summary

Xerophyta is a highly variable genus, one ripe for monographic study. Both morphologically and anatomically the new taxon most closely resembles this sympatric genus, although within *Xerophyta* it is a very clearly marked species, easily distinguished by its connate anthers and its well-developed corona. It is also unusual in having a glabrous, eglandular inflorescence and ovary, and is the only member of its family known from northern Madagascar.

Photographs of *Xerophyta connata* can be viewed on the World Wide Web at http://www.mobot.org/MOBOT/Madagasc/velloz.html.

Acknowledgments. We thank John Myers for the drawing, George Schatz for checking the collections at P for other specimens of the new species and for putting the photographs on the World Wide Web, and R. de Mello-Silva for bringing important recent literature to our attention. This study was supported in part by the National Science Foundation through grant number DEB-9201061 to Henk van der Werff.

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Appendix. Voucher specimens at MO examined anatomically.

Barbacenia glauca Martius ex Schultes & Schultes f., *Hatschbach 49732*, Brazil.
Barbacenia stenophylla Goethart & Henrard, *Irwin et al. 9901*, Brazil.
Barbaceniopsis vargasiana (L. B. Smith) L. B. Smith, *Vargas 9991*, Peru.
Nanuza plicata (Martius) L. B. Smith & Ayensu, *Davidse et al. 11823*, Brazil.
Talbotia elegans Balfour, *Meyer 3342*, cult: London; S. Africa.
Vellozia glauca Pohl, *Irwin 21395*, Brazil.
Vellozia ornata Martius ex Schultes & Schultes f., *Hatschbach 51124*, Brazil.
Xerophyta connata sp. nov., *McPherson & van der Werff 16374*, Madagascar.
Xerophyta dasylirioides Baker, *McPherson & van der Werff 16482*, Madagascar.
Xerophyta eglandulosa H. Perrier, *McPherson & van der Werff 16459*, Madagascar.
Xerophyta equisetoides Baker, *Plowes 1492*, Zimbabwe.
Xerophyta pinifolia Lamarck, *Mabberly 1020*, Madagascar.
Xerophyta scabrida (Pax) T. Durand & Schinz, *Balslev 42*, Tanzania.
Xerophyta suaveolens (Greves) N. L. Menezes, *Harder et al. 2161*, Zambia.
Xerophyta sp., *Harder et al. 2077*, Zambia.

A New Species of *Bourreria* (Boraginaceae) from Costa Rica

James S. Miller and Bénédicte Sirot
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. *Bourreria grandicalyx* is described as new from Costa Rica, and a key is provided to the large-flowered species of the genus, a group restricted to continental tropical America.

In preparing a treatment of Boraginaceae for *A Manual to the Plants of Costa Rica*, two collections of a species of *Bourreria* that was previously undescribed were discovered.

Bourreria grandicalyx J. S. Miller & Sirot, sp. nov. TYPE: Costa Rica. Puntarenas: Parque Nacional Corcovado Aguas arriba de Río Rincon, camino al Cerro do Oro, 50–400 m, 8°35′N, 83°30′W, 30 July 1990 (fl, fr), *Abelardo Chacón 950* (holotype, MO 5022360; isotypes, BM, CR, GH, INBIO, MEXU, PMA, US). Figure 1.

Arbor usque ad 8 m alta. Folia persistentia; lamina glabra, obovata vel elliptica, 16–20(–25) cm longa, 5–7 cm lata, apice rotundata ad acuta, saepe abrupte acuminata, basi acuta ad fere obtusa, interdum petiolo breviter decurrente; petiolo 2.5–5 cm longo, glabro. Inflorescentia terminalis, cymosa, 2–6 flora. Flos calyce 2.5–4 cm longo, glabro, sed trichomatibus crispatis ad marginem ciliato; corolla alba, tubulari, 6.5–9 cm longa, ad apiceum 4–6 cm lata, 5-lobulata, lobulis transverse late ovatis, 1.7 cm longis, 2–2.2 cm latis; staminibus 5, filamentis glabris. Fructus drupaceus, transverse ellipsoideus, 2.5 cm longus, 3 cm latus, maturitate intra calycem accrescentem 4.0–5.5 cm longum omnino inclusus; pyrenis 4, ad medianum affixis, alatis.

Tree to 8 m tall, 20 cm DBH, the twigs glabrous, the young portions smooth, drying black. Leaves persistent; blades obovate or less commonly somewhat elliptic, 16–20(–25) cm long, 5–7 cm wide, the apex rounded to acute, and often abruptly acuminate, the base acute to nearly obtuse, sometimes shortly decurrent along the petiole, the margin entire, both surfaces glabrous, the venation brochidodromous, the midrib impressed above, prominently elevated below, the secondary veins 6–11; petioles 2.5–5 cm long, glabrous, canaliculate on the adaxial surface. Inflorescence terminal, a 2–6-flowered cyme, each flower borne on a branch, (1.5–)2.5–4(–6) cm long. Flowers bisexual; calyx 2.5–4 cm long, 2.7–4.5 cm wide at the mouth, the 5 lobes 1.4–2.5 cm long, the exterior and interior surfaces glabrous but with a distinct row of dense, curly hairs along the inner edges of the lobes; corolla white, tubular, 6.5–9 cm long, 4–6 cm wide at the apex, the 5 lobes widely depressed ovate, 1.7 cm long, 2–2.2 cm wide; stamens 5, the filaments glabrous, 4.3–4.4 cm long, the upper 3 mm free, the anthers 4–4.5 mm long; ovary indistinct, not clearly differentiated from the base of the style, the style 3 cm long, the branches 7 mm long, the stigmas capitate. Fruits drupaceous, transversely ellipsoid, 2.5 cm long, 3 cm wide, completely enclosed in the accrescent calyx at maturity, the calyx enlarged to 4–5.5 cm long, the 4 pyrenes attached to the gynobase at their midpoint, with ca. 6 prominent, overlapping, papery dorsal wings ca. 3 mm high.

Bourreria grandicalyx is known only from the Osa Peninsula in Costa Rica where it occurs from 50 to 400 m in wet forests.

Paratype. COSTA RICA. **Puntarenas:** Cantón de Osa Rancho Quemado, Estón Forestal, Finca Eloy Cubero, elev. 230 m, 8°41′05″N, 83°33′50″W, *Marín 120* (MO).

Bourreria grandicalyx is a distinctive species characterized by its large corolla and calyx and is the only *Bourreria* with fruits completely enclosed by the accrescent fruiting calyx. It is most closely related to *Bourreria costaricensis* (Standley) A. Gentry, with which it shares large flowers, fruits that are round in cross section, the largest fruits in the genus, and pyrenes with a median attachment to the gynobase.

Bourreria is a complex genus in need of taxonomic revision, and it comprises an assemblage of species with a wide variety of morphological appearances (Thulin, 1987; Miller, 1989). *Bourreria grandicalyx* is the largest-flowered species in the genus and is most closely related to the other species with large flowers and pyrenes with membranous ridges, all of which are distributed in mainland tropical America from Mexico to Colombia and Venezuela. With the exception of *B. grandicalyx* and *B. costaricensis*, all of the large-flowered species of *Bourreria* have pyrenes with apices attached to the gynobase by a slender fiber, a group that has been segregated as the genus *Crematomia* Miers (Miers, 1869), but not all members of Miers's genus

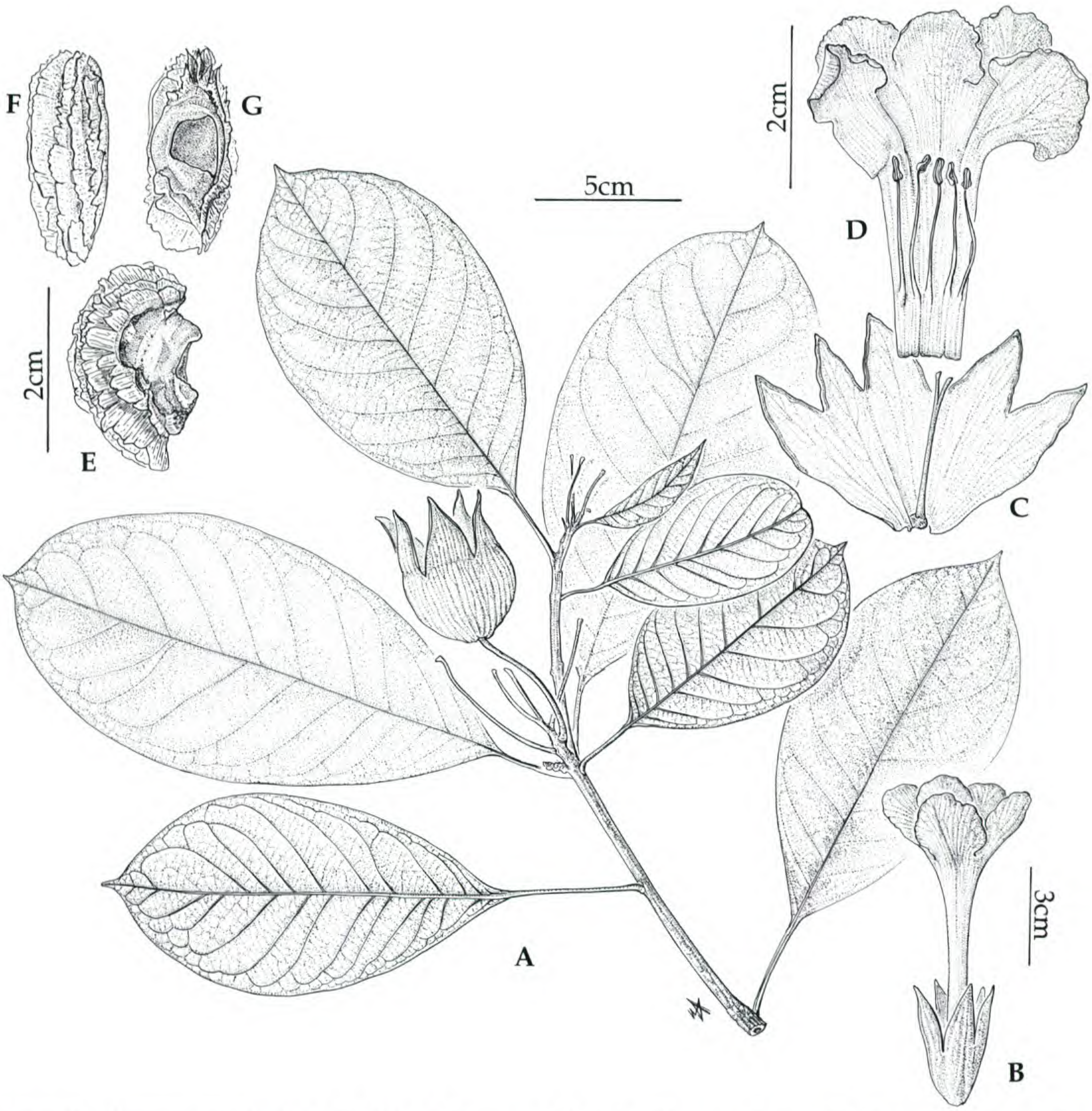

Figure 1. *Bourreria grandicalyx* J. S. Miller & Sirot. —A. Branch with mature fruit. —B. Flower. —C. Open calyx with gynoecium. —D. Open corolla with stamens. —E. Lateral surface of pyrene showing raised, papery wings. —F. External surface of pyrene showing overlapping wings. —G. Internal surface of pyrene showing the point of median attachment. All from *Chacón 950* (MO).

had large corollas. The key provided below to the large-flowered species of *Bourreria*, which occur in Mexico, Central America, and northern South America, is for diagnostic purposes and not meant to indicate the boundaries of a natural group.

KEY TO THE LARGE-FLOWERED SPECIES OF *BOURRERIA*

1a. Petioles greater than 10 mm long; leaf blade greater than 6 cm long; plants usually trees.
  2a. Leaves glabrous on the lower surface; fruits round in cross section; fruiting calyx enlarged.
    3a. Flowering calyx greater than 2.5 cm long; edges of the lobes pubescent; fruits completely enclosed by the accrescent calyx; Costa Rica . . . . . *B. grandicalyx* J. S. Miller & Sirot
    3b. Flowering calyx less than 1.8 cm long; edges of the lobes glabrous; fruits not enclosed by the calyx; Nicaragua to Colombia . . . . . *B. costaricensis* (Standley) A. H. Gentry
  2b. Leaves puberulent on the lower surface; fruits 4-angled; calyx not enlarged in fruit (fruit unknown in *B. superba*).
    4a. Inflorescence 5–10-flowered; pedicels greater than 10 mm long; corolla greater than 4 cm long; Mexico . . . . . *B. superba* I. M. Johnston
    4b. Inflorescence with many flowers; pedi-

cels less than 6 mm long; corolla less than 4 cm long; Mexico to Nicaragua . . . *B. huanita* (La Llave & Lexarza) Hemsley

1b. Petioles less than 10 mm long; leaf blade less than 7.5 cm long; plants shrubs or small trees.

5a. Leaves asperous above; leaf blades broadest above the middle; Mexico . . . . . *B. hintonii* I. M. Johnston

5b. Leaves glabrous or nearly so above; leaf blades broadest below the middle.

6a. Corolla less than 4.4 cm long, less than 3 cm wide at the mouth; Venezuela, Colombia . . . . . *B. cumanensis* (Loefling) O. E. Schulz

6b. Corolla greater than 6.3 cm long, greater than 3 cm wide at the mouth; Nicaragua, Costa Rica . . . *B. quirosii* Standley

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Notes on Neotropical *Parathesis* (Myrsinaceae)

Jon M. Ricketson
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.;
ricketson@lehmann.mobot.org

John J. Pipoly III
Botanical Research Institute of Texas, 509 Pecan Street,
Fort Worth, Texas 76102-4060, U.S.A.; jpipoly@brit.org

ABSTRACT. *Parathesis costaricensis*, *P. glendae*, and *P. longipedicellata* are described and illustrated, and their phylogenetic relationships are discussed. A key is provided to separate the new species. In addition, a new combination is made for *Parathesis sinuata* (from Colombia), and *P. amazonica* Mez is lectotypified.

The genus *Parathesis* J. D. Hooker contains 100 species distributed from northern Mexico to Panama, the Caribbean, and throughout the Andes from Venezuela to Bolivia. The genus is defined by the unique glandular papillae of the calyx and corolla lobes, and bright yellow anthers. In preparation for our treatment of the genus *Parathesis* for *Flora Mesoamericana*, three new species from Costa Rica were discovered and are described herewith. A new combination from Colombia is also made, and *Parathesis amazonica* is lectotypified.

Parathesis costaricensis Ricketson, sp. nov. TYPE: Costa Rica. Limón Cantón: Cordillera de Talamanca, along Río Madre de Dios, near edge of river, 10°03′N, 83°26′W, 240–300 m, 2 Sep. 1988 (fl), *Michael Grayum, Gerardo Herrera & Rafael Robles 8681* (holotype, MO; isotypes, BRIT, CR not seen, US). Figure 1.

Quoad inflorescentiam terminalem, antheras versatiles necnon folia magne grosseque pubescentes trichomatibus erectis dendroideisque, *P. longipedicellato* valde arcte affinis, sed ab ea rhachidibus inflorescentiarum cacaino-(non fuliginoso-)dendroideo-tomentosis, pedicellis 4.0–5.5 (non 6.0–9.0) mm longis, lobis calycis deltatis (non ovatis) 0.8–1.2 (nec 1.2–1.4) mm longis, filamentis staminibus 2.2–2.5 (non 2.5–3.0) mm longis, denique antheris sine apiculis (non apiculatis) praeclare distinguitur.

Tree 5 m tall. Branchlets thick, terete, 0.4–0.9 cm diam., densely appressed dark reddish chocolate-brown dendroid-tomentose, the hairs erect. Leaf blades chartaceous, elliptic or oblong-elliptic, 20–32 cm long, 7–14 cm wide, apically acute to acuminate, basally broadly acute, decurrent on the petiole, the midrib impressed above, prominently raised below, the secondary veins conspicuous, 30–50 pairs, impressed above, prominently raised below, prominently red punctate above, conspicuously red punctate-lineate below, the entire upper surface with scattered dendroid hairs, densely tomentose along midrib, usually glabrate with age, the lower surface inconspicuously bizonal, tomentum of erect dendroid hairs, densely so along the midrib and secondary veins, the margins flat, subentire to obscurely or minutely crenulate. Petioles marginate, stout, 4.5–6 cm long, dark reddish chocolate-brown dendroid-tomentose throughout. Inflorescences terminal and in the axils of the uppermost leaves, pyramidal-paniculate, bipinnately compound; peduncles 2–3.5 cm long, the rachis somewhat flexuous, the rachis and branchlets densely tomentose with dark reddish chocolate-brown dendroid hairs intermixed with papillae; pedicels angulate, 4–5.5 mm long, appressed dark reddish chocolate-brown papillose. Flowers occurring in clusters of 4–15, 5(–6)-merous, coriaceous, 6–7 mm long, densely and prominently black punctate, obscured by a dense dark reddish chocolate-brown papillose-tomentum; sepals deltoid, 1.5–2 mm long, 1–1.5 mm wide, the tube 0.7–0.8 mm long, the lobes 0.8–1.2 mm long, 0.8–1.2 mm wide, the apex acute, densely and prominently black punctate, obscured outside, prominent inside, appressed dark reddish chocolate-brown papillose-tomentose outside, glabrous within, the margins papillose; petals linear-lanceolate, 5.5–6.5 mm long, 1–1.2 mm wide at base, the tube 0.4–0.5 mm long, the lobes 5–6 mm long, 0.8–1.5 mm wide, the apex acute, black punctate and punctate-lineate, conspicuous outside, prominent within, outer surface papillose, sparsely villous within, more densely so along the margins and apically, glabrous only at the very base; stamens 2.5–3 mm long; the filaments flat, 2–2.5 mm, black punctate-lineate, glabrous; the anthers versatile, linear-lanceolate, 1.4–1.8 mm long, the apex 0.1–

Figure 1. *Parathesis costaricensis* Ricketson. —A. Habit, flowering branch. —B. Detail of inflorescence. —C. Detail of abaxial leaf surface. —D. Stamen, showing protandrous anther before becoming versatile. A–D drawn from holotype.

0.3 mm wide, the base 0.6–0.8 mm wide, apically obtuse to acutish, basally cordate to somewhat sagittate, the connective dorsally black-punctate its entire length, dehiscent by longitudinal slits, open before anthesis; ovary globose, densely dark reddish chocolate-brown hirsute tomentose throughout, the style 4–5 mm, densely tomentose basally, glabrous above, the placenta obnapiform, with 9–11 uniseriate ovules. Fruits unknown.

Distribution. *Parathesis costaricensis* is endemic to Costa Rica, known only from the type collection.

Ecology. This species grows in lowland tropical moist forest and has protandrous flowers that are probably self-compatible.

Parathesis costaricensis is similar to *P. longipedicellata* in general appearance and tomentum of the branchlets and undersurface of the leaf blades, but differs by its much shorter pedicels. *Parathesis costaricensis* differs from *P. amplifolia* from Panama and *P. cartagoana* from Costa Rica in the tomentum of the undersurface of the leaf blades mostly erect and inconspicuously bizonal versus mostly appressed and conspicuously bizonal. *Parathesis costaricensis* also differs from *P. glendae* from Costa Rica and *P. croatii* from Panama in the tomentum of the branchlets of erect dark reddish chocolate-brown versus appressed and light tannish brown or dark brown.

Parathesis glendae Ricketson, sp. nov. TYPE: Costa Rica. Limón Cantón: Parque Internacional La Amistad, Quebrada Crori, Croriña, 9°25′15″N, 82°59′00″W, 600 m, 20 July 1989 (fl), *Abelardo Chacón 240* (holotype, MO; isotypes, BRIT, CR not seen, F). Figure 2.

Propter inflorescentiam terminalem, antheras versatiles, folia magne grosseque pubescentia, trichomatibus erectis bizonaliterque rufo-dendroideo-tomentosis, *P. croatio* valde arcte affinis, sed ab ea inter petala atque apicem tubis corollinae papillis brunneis indutis (non glabris), petiolis 6–7.5 (non 3.5–4.5) cm longis, floribus 6.5–7.0 (non 8.0–9.0) mm longis, lobis calycis 0.8–1.0 (non 1.5–2) mm longis, denique lobis corollinae 6.0–6.2 (non 7.5–8.5) mm longis statim distinguitur.

Tree 15 m tall, 25 cm DBH. Branchlets thick, terete, 0.6–1 cm diam., densely appressed short light brown dendroid-tomentose. Leaf blades chartaceous, elliptic or oblong-elliptic, 20–46 cm long, 9–16 cm wide, apically acute to acuminate, basally acute, decurrent on the petiole, the midrib impressed above, prominently raised below, the secondary veins conspicuous, 45–65 pairs, slightly impressed above, prominently raised below, prominently red punctate and punctate-lineate above, conspicuously red punctate and punctate-lineate below, the upper surface mostly glabrous, occasionally with a few scattered light brown dendroid-tomentose hairs when young, generally with appressed short, light brown dendroid hairs along the midrib, the lower surface conspicuously bizonal when young, less prominently so with age, light brown appressed dendroid- or stellate-tomentose, occasionally with a few, scattered, erect trichomes, generally conspicuous along the midrib and secondary veins, denser around the midrib, thinning to generally glabrous toward the margins; the margins flat, conspicuously minutely crenulate. Petioles canaliculate, stout, 6–7.5 cm long, densely appressed short light brown dendroid-tomentose outside when young, glabrescent with age, glabrous within. Inflorescences terminal and in the axils of the uppermost leaves, pyramidal-paniculate, bipinnately compound, straight and mostly erect, the flowers generally congested at the nodes; pedicels angulate, 3–6 mm long, almost completely black-punctate, densely to scattered light brown papillose-tomentose. Flowers occurring in clusters of 5–12, 5-merous, coriaceous, 6.5–7 mm long, densely light brown papillose-tomentose; sepals deltoid, 1–1.2 mm long, 0.8–1 mm wide, the tube 0.2–0.4 mm long, the lobes 0.8–1 mm long, 0.8–1 mm wide, the apex acute, black-punctate and punctate-lineate, mostly obscured outside, prominent within, densely light brown papillose-tomentose outside, glabrous within, the margins papillose; petals narrowly lineate-lanceolate, 6–6.5 mm long, 1–1.2 mm wide at base, the tube 0.3–0.5 mm long, the lobes 6–6.2 mm long, the apex acute, black-punctate and punctate-lineate, conspicuous outside, prominent within, outer surface densely to scattered light brown papillose, scattered villous tomentose over entire inner surface, except glabrous at very base and long villous tomentose along the margins and apex, a large rounded mound of tufted short light brown papillae between each of the lobes of the petals and each of the filaments, on the rim of the corolla tube; stamens 3–3.5 mm long, the filaments flat, 2.5–2.8 mm, black-punctate-lineate, glabrous, the anthers versatile, linear-lanceolate, apically obtuse to acutish, basally cordate to somewhat sagittate, 1.2–1.5 mm long, the apex 0.3–0.5 mm wide, the base 0.5–0.8 mm wide, the connective dorsally narrowly black-punctate only around the middle, dehiscent by longitudinal slits, open before anthesis; ovary globose-lobed, generally 5-lobed, densely short light brown villous-tomentose throughout, the style 4.5–4.8 mm long, usually dark red-black, completely glabrous, the placenta obnapiform, with 10–12 biseriate ovules. Fruit unknown.

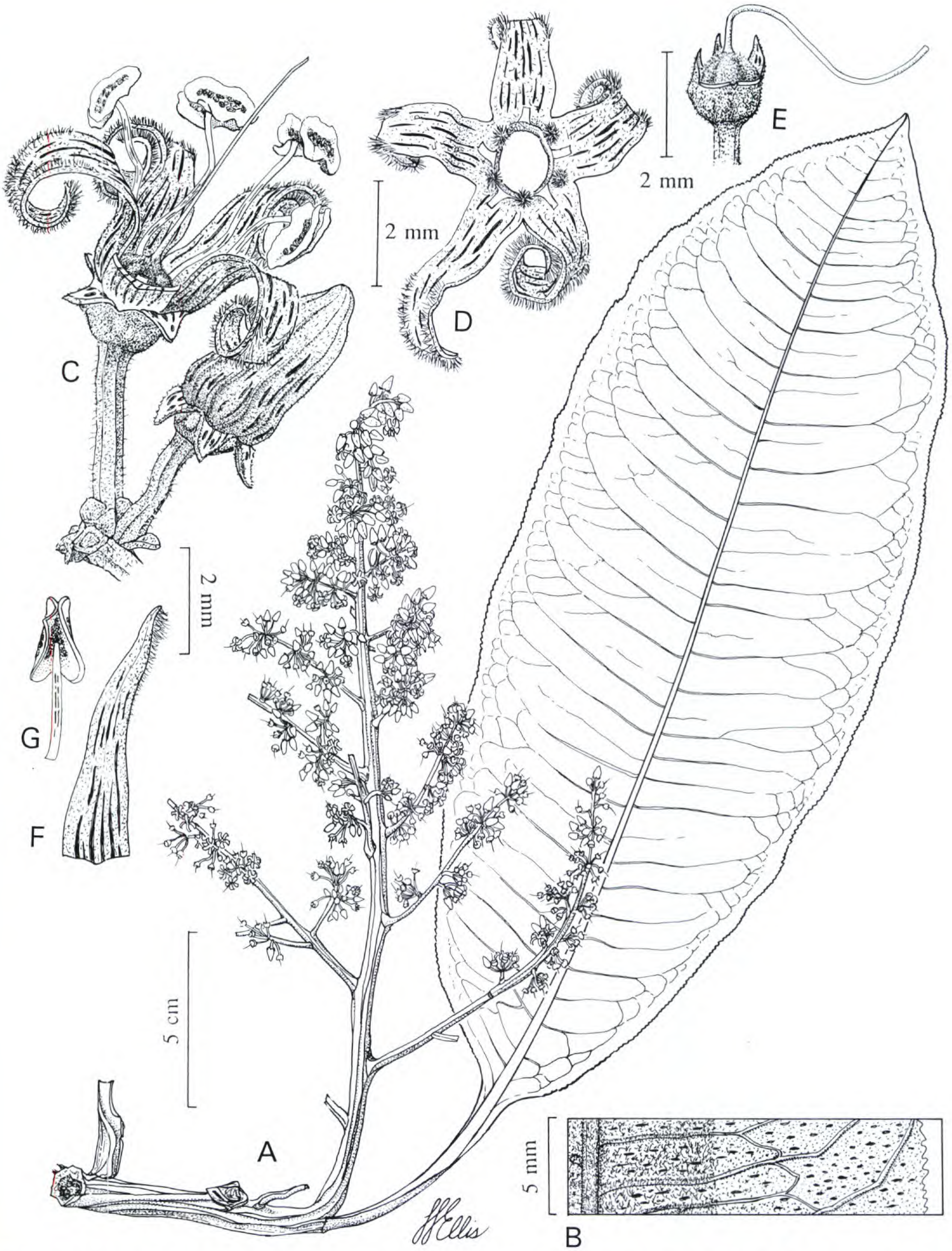

Figure 2. *Parathesis glendae* Ricketson. —A. Habit, flowering branch. —B. Detail of abaxial leaf surface. —C. Detail of inflorescence, with petal and stamen removed (F & G). —D. Detail of removed corolla tube (apical filaments and anthers removed). —E. Detail of immature fruit, with some sepal lobes removed. —F. Detail of abaxial petal surface. —G. Detail of stamen. A, B drawn from BRIT isotype. C–F drawn from holotype.

Distribution. *Parathesis glendae* is endemic to Costa Rica, known only from the type collection.

Ecology. This species has protandrous flowers that are probably self-compatible.

Etymology. It gives me great pleasure to dedicate this spectacular new species to my bride, Glenda (neé Hahn) Ricketson, for her steady encouragement and support for my work.

Parathesis glendae is unique in the group of plants with terminal inflorescences, versatile anthers, and large leaves because of the tufted mounds of short, light brown papillae between the lobes of the petals and filaments on the rim of the corolla tube. It is similar to *Parathesis croatii* from Panama in the appressed tomentum of the branchlets, but differs primarily in the tufted mounds of papillae on the corolla tube. *Parathesis glendae* is also distinguished from both *P. amplifolia* from Panama and *P. cartagoana* from Costa Rica in the tomentum of the underside of the leaf blades. From both *Parathesis costaricensis* and *P. longipedicellata* from Costa Rica, *P. glendae* may be separated by the appressed, short, light brown dendroid tomentum on the branchlets.

Parathesis longipedicellata Ricketson, sp. nov. TYPE: Costa Rica. Puntarenas Cantón: Parque Nacional Corcovado Gira de Corcovado, Acro de Piedra to Río Corcovado, 8°28′N, 83°35′W, 1–30 m, 17 June 1989 (fl), *C. Kernan 1155* (holotype, MO; isotypes, BRIT, CR not seen, F, MO, NY, TEX, US, US). Figure 3.

Quoad inflorescentiam terminalem, antheras versatiles necnon folia magne grosseque pubescentia trichomatibus erectis dendroideisque, *P. costaricensi* valde arcte affinis, sed ab ea rhachidibus inflorescentiarum fuliginoso-(non cacaino-)dendroideo-tomentosis, pedicellis 6.0–9.0 (non 4.5–5.0) mm longis, lobis calycis ovatis (non deltatis) 1.2–1.4 (nec 0.8–1.2) mm longis, filamentis staminibus 2.5–3.0 (non 2.2–2.5) mm longis, denique antheris apiculatis (nec sine apiculis) praeclare distinguitur.

Tree 8–22 m tall, 10–26.3 cm DBH, latex red. Branchlets thick, terete, 0.5–1 cm diam., densely matted ferruginous dendroid-tomentose, the hairs erect. Leaf blades chartaceous, elliptic or oblong-elliptic, 17–36 cm long, 9–15 cm wide, apically acute to acuminate, basally acute to slightly oblique, decurrent on the petiole, the midrib impressed above, prominently raised below, the secondary veins conspicuous, 30–50 pairs, slightly impressed above, prominently raised below, conspicuously black punctate, infrequently punctate-lineate above, inconspicuously black punctate below, the entire upper surface tomentose with scattered ferruginous erect dendroid hairs, at least when young, generally glabrescent with age, densely matted erect ferruginous dendroid tomentum along the upper midrib, ± persistent, the lower surface densely tomentose with persistent erect ferruginous dendroid hairs on the midrib and secondary veins, with only scattered persistent erect hairs near the midrib, denser toward the margins, thus conspicuously bizonal below when young, inconspicuously bizonal with age; the margins flat, subentire to obscurely or minutely crenulate. Petioles marginate, stout, 3.5–8.5 cm long, densely matted erect ferruginous dendroid-tomentose throughout. Inflorescences terminal and in the axils of the uppermost leaves, pyramidal-paniculate, nearly twice as wide as long, bipinnately compound, the rachis somewhat flexuous, the flowers generally loosely open at the nodes; the principal branchlets subtended by reduced leafy bracts, the blades chartaceous, elliptic to oblong-elliptic, 9–17 cm long, 2.5–5.5 cm wide, otherwise as in the vegetative leaves; petioles 2–3.5 cm long, densely matted erect ferruginous dendroid-tomentose; pedicels terete to slightly angulate, 6–9 mm long, densely erect ferruginous dendroid-tomentose intermixed with light brown or ferruginous papillae. Flowers occurring in clusters of 4–10, 5-merous, coriaceous, 6.5–7.5 mm long, black punctate-lineate, erect ferruginous dendroid-tomentose intermixed with ferruginous papillae; sepals ovate, 1.4–1.8 mm long, 0.8–1 mm wide, the tube 0.2–0.6 mm long, the lobes 1.2–1.4 mm long, 1.4–1.6 mm wide, sinuses wide, the apex acute, black punctate, inconspicuous without, conspicuous within, erect ferruginous dendroid-tomentose intermixed with ferruginous papillae without, glabrous within, the margins ferruginous dendroid-tomentose and papillose; petals narrowly lanceolate, 6–7 mm long, 1.6–1.8 mm wide, the tube 1–2 mm long, the lobes 5–6 mm long, 1.6–1.8 mm wide, the apex acuminate, black punctate and punctate-lineate inconspicuously without, conspicuously so within, outer surface erect ferruginous dendroid-tomentose intermixed with ferruginous papillae, inner surface scattered erect ferruginous villous-tomentose intermixed with ferruginous papillae along the margins and apex to near the middle, usually densely matted at the apex, glabrous from near the middle to the base; stamens 2.5–3.5 mm long, the filaments flat, 2.5–3 mm long, black punctate-lineate, glabrous, the anthers tardily versatile, linear-lanceolate, 1.5–1.8 mm long, the apex 0.2–0.3 mm wide, the base 0.4–0.6 mm wide, apically obtuse to acutish, apiculate, basally cordate to sagittate, the connective dorsally black punctate through most of its length, dehiscent by longitudinal slits, open before

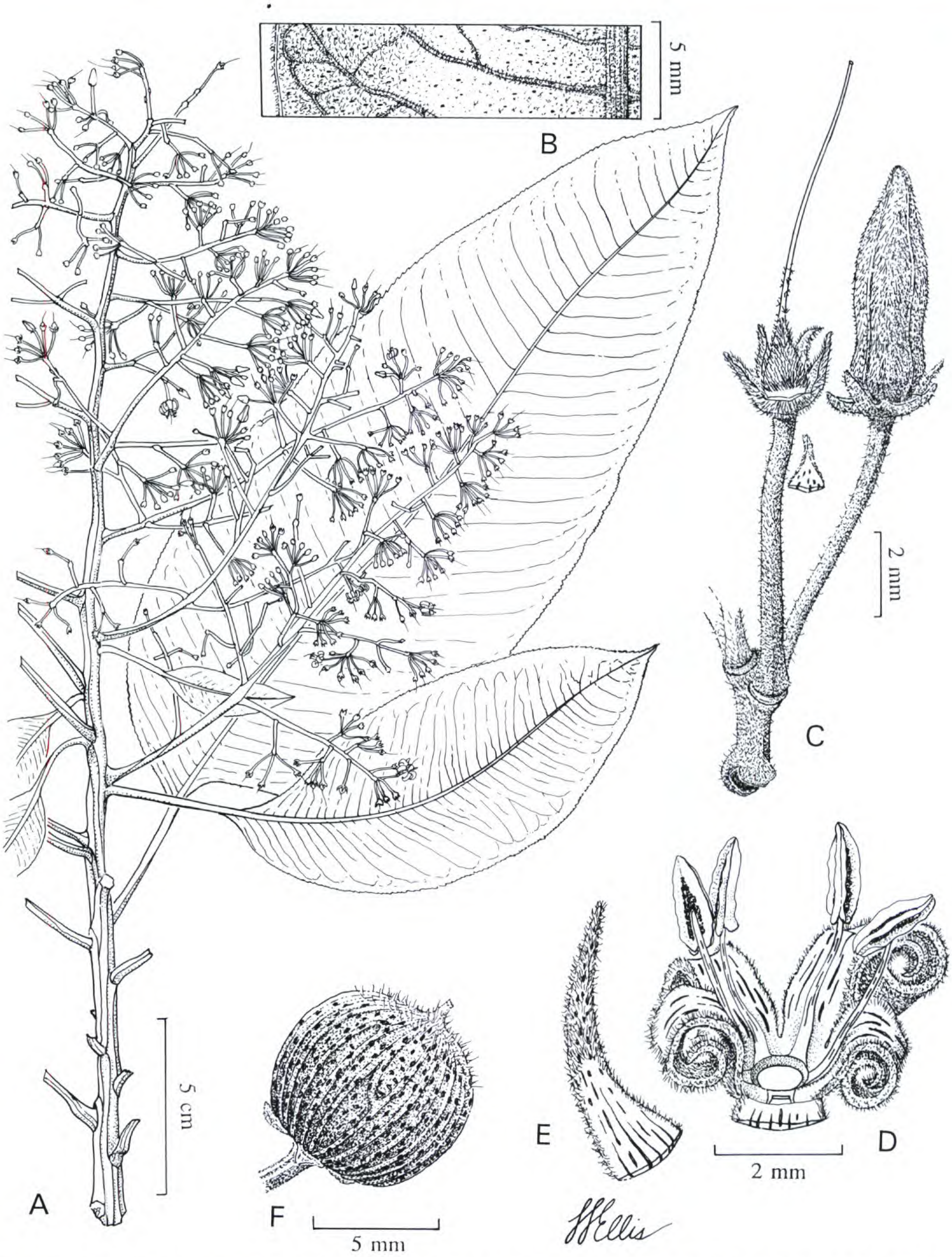

Figure 3. *Parathesis longipedicellata* Ricketson. —A. Habit, flowering branch. —B. Detail of abaxial leaf surface. —C. Detail of inflorescence, with sepal removed. —D. Detail of corolla tube with petal removed (E). —E. Detail of abaxial petal surface. —F. Mature fruit. A, B drawn from MO isotype. C–E drawn from holotype. D drawn from *Marin 500* (MO).

anthesis; ovary globose, upper ⅔ densely erect ferruginous hirsute tomentose, with a distinct glabrous band around the base, the style 4.5–5 mm long, dark reddish to black, lower half with scattered ferruginous dendroid tomentum, the upper half glabrous, the placenta obnapiform, with 12 uniseriate ovules. Fruit globose, longitudinally costate, 6–9.5 mm diam., minutely pubescent over upper half to ⅔ of the fruit, costa evident.

Distribution. *Parathesis longipedicellata* is endemic to the Osa Peninsula in Puntarenas Cantón of Costa Rica. Sea level to 350 m elevation.

Ecology. This species is occasional in tall wet forests and has protandrous flowers that are probably self-compatible.

Parathesis longipedicellata differs from all other species of the group with terminal inflorescences, versatile anthers, and large leaves primarily because of the unusually long pedicels. It is similar to *Parathesis costaricensis* in the tomentum of the branchlets and undersurface of the leaves, and differs in the tomentum color, shape of the inflorescence, and length of the pedicels, sepals, and filaments. *Parathesis longipedicellata* differs from *P. amplifolia* from Panama and *P. cartagoana* from Costa Rica in the tomentum on the undersurface of the leaf blades. It may also be distinguished from both *Parathesis glendae* from Costa Rica and *P. croatii* from Panama by the tomentum on the branchlets.

Paratypes. COSTA RICA. **Puntarenas Cantón**: Reserva Forestal Golfo Dulce Osa Península, Trocha de La Tarde road 10 km SW of La Palma, S of Rincón de Osa, E of the Río Rincón valley, 8°37′N, 83°28′W, 150–200 m, 28 Apr. 1988 (fl), *B. Hammel & R. Robles 16768* (CR not seen, MO, US); Región GOLFITO Sección "Bosque de los Austriacos," primary forest, Research Plot, La Gamba, 8°41′N, 83°13′W, 300 m, 09 Dec. 1993 (fl), *W. Huber & A. Weissenhofer 26* (MO, W not seen); Osa, Rancho Quemado, Sector Oeste, Sierpe, 8°41′00″N, 83°35′40″W, 350 m, 25 Aug. 1992 (fr), *J. Marín & G. Marín 500* (BRIT, CR not seen, INB not seen, MO); Osa Peninsula, Aguabuena, 3.5 km W of Rincón, one-hectare permanent sample plot, 800 m N of the house of Henry Monge in well-drained, moderately sloping terrain, tall forest along timber road, left after selective logging Mar. 1992, Plot # 3144, 8°42′N, 83°30′W, 130 m, 17 Apr. 1993 (fl), *K. Thomsen 876* (BRIT, C not seen, K not seen, USJ not seen); Osa, P.N. Corcovado, Península de Osa, Estación San Pedrillo, sendero que va al límite, 8°37′00″N, 83°44′00″W, 100 m, 21 Sep. 1993 (fr), *Reinaldo Aguilar 2364* (CR not seen, INB not seen, MO, NY not seen); Golfito, P.N. Corcovado, Península de Osa, Estación Los Patos, Cerro Degra, 8°34′00″N, 83°31′00″W, 200 m, 5 June 1994 (fl, fr), *Reinaldo Aguilar 3335* (BRIT, CR not seen, INB not seen, MO); Osa Peninsula, Aguabuena, 3.5 km W of Rincón, along trail leading N from the house of Don Quecho, W of BOSCOSA station, Plot # 2153, tall undisturbed forest in elevated, well-drained terrain, 8°42′N, 83°31′W, 250 m, 27 July 1994 (fr), *K. Thomsen 1066* (C not seen, CR not seen, K not seen, MO, USJ not seen).

Parathesis costaricensis, *P. glendae*, and *P. longipedicellata* belong in a group of plants with terminal inflorescences, versatile anthers, and large leaves. *Parathesis acostensis* Morales (Morales, 1996) is included here because it is vegetatively very similar to *P. longipedicellata*. However, it can readily be separated from *P. longipedicellata* and the rest of the group based on its unusual persistent foliaceous inflorescence bracts and erect anthers. The following key may be used to separate these related species.

KEY TO *PARATHESIS COSTARICENSIS*, *P. GLENDAE*, *P. LONGIPEDICELLATA*, AND RELATED SPECIES

1a. Anthers erect, dorsifixed to ¼ their length; foliaceous inflorescence bracts scattered throughout inflorescence . . . . . *P. acostensis* Morales

1b. Anthers versatile, dorsifixed ⅓–½ their length; foliaceous inflorescence bracts restricted to lower ⅓ of inflorescence.

2a. Abaxial leaf surface with a densely appressed, fine, whitish bizonal tomentum, the costal zone with intermixed erect, rufous dendroid hairs.

3a. Petals 5.5–6 mm long, thin and membranaceous; anthers 2.3–2.5 mm long, 0.4–0.6 mm wide; inflorescence rachis and branchlets with conspicuously coarse dark red-brown dendroid hairs; lower leaf surface usually obviously bizonal . . . . . *P. amplifolia* Lundell

3b. Petals 8–9 mm long, thick and coriaceous; anthers 2.8–3.0 long, 1.2–1.8 mm wide; rachis and branchlets with usually closely appressed, tawny-brown stellate hairs; lower leaf surface not usually obviously bizonal . . . . . *P. cartagoana* Lundell

2b. Abaxial leaf surface with mostly erect, red dendroid tomentum, especially along the costa and lateral veins, usually bizonal, often inconspicuously so, the marginal zones generally glabrous, or if tomentose then of a lighter colored, appressed tomentum.

4a. Branchlet tomentum of dark brown or dark reddish chocolate-brown, erect hairs.

5a. Tomentum dark reddish chocolate-brown; pedicels 4–5.5 mm long; calyx lobes deltoid, 0.8–1.2 mm long; filaments 2–2.5 mm long . . . . . *P. costaricensis* Ricketson

5b. Tomentum dark brown; pedicels 6–9 mm long; calyx lobes ovate, 1.2–1.4 mm long; filaments 2.5–3 mm long . . . *P. longipedicellata* Ricketson

4b. Branchlet tomentum of light tannish brown to dark brown appressed hairs, rarely with scattered erect hairs.

6a. Corolla tube apex glabrous between

the lobes and filaments; petioles 3.5–4.5 cm long; flowers 8–9 mm long; sepal lobes 1.5–2 mm long; petal lobes 7.5–8.5 mm long . . . . . *P. croatii* Lundell

6b. Corolla tube apex with rounded tufts of short light brown papillae between the lobes and filaments; petioles 6–7.5 cm long; flowers 6.5–7 mm long; sepal lobes 0.8–1 mm long; petal lobes 6–6.2 mm long . . . . . *P. glendae* Ricketson

In addition to the aforementioned novelties, revision of the genus disclosed the necessity of raising *Parathesis reticulata* var. *sinuata* to specific rank, and of lectotypifying *P. amazonica.*

Parathesis sinuata (Lundell) Ricketson & Pipoly, comb. nov. Basionym: *Parathesis reticulata* Lundell var. *sinuata* Lundell, Wrightia 3: 72. 1963. TYPE: Colombia. Departamento de Magdalena: Santa Marta, on the Donamo [Don Amo] road, about 400 ft. [122 m], 8 Apr. 1899, *Herbert H. Smith 1724* (holotype, NY; isotypes, F, GH, LL-TEX, MICH, MO, US).

Some confusion has occurred because the protologue differs slightly from the actual label data. A handwritten note on the NY holotype, penned in H. H. Smith's own hand states: "Occasional on the banks of streams in the forest, below 1200 ft. . . . Specimen collected on the Donamo [Don Amo] road about 400 ft. Apr. 8 [1899]." Unfortunately, duplicates were distributed with incomplete data information: while the elevation was correctly given as 400 ft., the location was given only as "Plants of Santa Marta," and the date given only as Apr. 1898–1901.

Lundell misunderstood this taxon as a variety of *P. reticulata,* but it actually belongs to a group of species with terminal inflorescences; erect anthers; tomentum of the branchlets and the undersurface of the leaves fine, mostly stellate, and usually closely appressed, often glabrescent; and ovary tomentose at least apically or along the costa. *Parathesis reticulata* possesses all of these characters except it has a glabrous ovary. *Parathesis reticulata* actually belongs to a complex containing 17 species, typified by *P. crenulata,* because of its characteristic terminal inflorescences; erect anthers; tomentum of the branchlets and the undersurface of the leaves fine, mostly stellate, and usually closely appressed, often glabrescent; and ovary mostly glabrous. While gross morphology of the leaves and appressed-tomentose branchlets, concomitant with erect anthers, are shared between *P. sinuata* and *P. reticulata,* the villous-tomentose ovary and sinuate versus reticulate leaf margins clearly separate *P. sinuata* from *P. reticulata.*

Specimens examined. COLOMBIA. **Comisaría Goajira [Departamento de La Guajira]:** along stream through forest 10 km S of Carraipia, 4 July 1944, *Oscar Haught 4236* (COL, GH, K, NY, UC, US); Municipio Riohacha, Corregimiento Tomarrazón, Inspección de policía La Gloria, 11°3.3′N, 73°0.3′W, 460 m, 2 Sep. 1990 (sterile), *Orlando Marulanda & Julio Betancur* (BRIT, HUA not seen, MO).

Parathesis amazonica Mez, Repert. Spec. Nov. Regni Veg. 16: 416. 1920. TYPE: Brazil. Acre: "Rio Acre, bei Seringal de São Francisco," Oct. 1911 (fl), *E. Ule 9686* (holotype, B destroyed; lectotype, here designated G; isolectotypes, K, LL-TEX (fragment)).

The specimen at G was selected as the lectotype over the K sheet, because it more closely matches the photo (F Neg. 4872: MO, LL-TEX) of the original B sheet (destroyed during WWII) in leaf size and shape and floral maturity.

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Literature Cited

Morales, J. F. 1996. Three new taxa for the Flora of Costa Rica. Phytologia 81: 361–364.

Two New Species of Quiinaceae (*Quiina*, *Froesia*) from the Venezuelan Guayana and Some Remarks on the Genus *Froesia* Pires

Julio Schneider and Georg Zizka

Botany/Paleobotany, Forschungsinstitut Senckenberg and J. W. Goethe-Universität, Senckenberganlage 25, D-60325 Frankfurt/Main, Germany

ABSTRACT. Two new species of Quiinaceae from the Venezuelan Guayana are described: *Quiina yatuensis* and *Froesia gereauana*. *Quiina yatuensis* is known from the Amazonian lowlands. The new *Froesia* species was found at high elevations in the Guayana Highlands, a center of local endemism. A key and distribution map for the species of *Froesia* Pires are given.

RESUMEN. Se describen dos especies nuevas de la familia Quiinaceae de la Guayana Venezolana: *Quiina yatuensis* y *Froesia gereauana*. *Quiina yatuensis* se encuentra en la Amazonía venezolana. La especie de *Froesia* se localiza a una elevación alta de la Guayana Venezolana, un centro de endemismo local. Se presentan una clave y un mapa de distribución para las especies de *Froesia* Pires.

The small neotropical family Quiinaceae is composed of medium-sized trees and shrubs, mainly located in the Amazon lowlands. At present 4 genera are recognized—*Froesia* Pires, *Lacunaria* Ducke, *Quiina* Aublet, and *Touroulia* Aublet—with about 55 species. Specimens were investigated in the context of the treatment of the family for the *Flora of the Venezuelan Guayana* (Schneider & Zizka, in prep.) and for the *Flora Neotropica*.

Quiina yatuensis Julio Schneider & Zizka, sp. nov. TYPE: Venezuela. T. F. Amazonas: Dpto. Río Negro, Río Yatúa, lomerío medio escarpado, 01°33′N, 66°15′W, ca. 250 m, apr. 1991, *Velazco, J. 1413* (holotype, PORT 50127). Figure 1.

Arbor parva, usque ad 8 m alta; internodiis terminalibus 2.2–3.6 × ca. 0.2 cm, compressis, pubescentibus. Folia opposita; stipulis 3.5–4.0 × 1.0–1.5 mm, triangulo-ovatis, glabris subglabrisve; petiolo 8–14 mm longo, subcylindrico, supra canaliculato; lamina 8–12 × 3.5–6.0 cm, coriacea, elliptica, ad apicem acuminata, ad basim acuto-angustata, glabra subglabrave, margine integro; nervis secundariis 8–10-jugatis, supra planis, infra prominulis. Inflorescentia fructifera solum visa, 2.0–2.5 × ca. 1.5 cm, axillaris, racemosa, 7–16-flora; axe cylindrico vel compresso, glabro subglabrove; pedicellis articulatis, usque ad 6.5 mm longis; bracteolis 0.6–0.8 × ca. 0.6 mm, ovatis subovatisve. Flos sepalis 4, in fructu persistentibus, 2.0–2.6 × 1.3–1.6 mm, ovatis vel obovatis, apice plus minusve obtusis, margine ciliolatis; petalis et staminibus non suppetentibus; ovario biloculari; stylis 2, stigmatibus oblique subpeltatis. Fructus 8.0–9.0 × 6.0–7.5 mm, subglobosus, striatus, glaber, pericarpio fibroso; seminibus 1–2, 6.5–7.0 × 4.5–5.0 mm, ovato-globosis, dense villosis.

Haec species a *Q. rigidifolia* Pires fructu minore, inflorescentia pauciflora et margine foliari minus vel non revoluto; a *Q. brevensi* Pires folii textura numeroque nervorum secundariorum et inflorescentiae structura differt.

Tree to 8 m tall; terminal internodes 2.2–3.6 × ca. 0.2 cm, laterally compressed, longitudinally striate, ± pubescent, glabrescent. Leaves opposite, not or inconspicuously anisophyllous; stipules 3.5–4.0 × 1.0–1.5 mm, triangular-ovate, apically acute, ± glabrous; petiole 8–14 × ca. 2 mm, subcylindrical, canaliculate above, sparsely pubescent or glabrous; lamina 8–12 × 3.5–6.0 cm, elliptical, apically acuminate, the very apex rounded, basally tapering, glabrous, coriaceous; margin not or inconspicuously revolute, entire; secondary veins in 8–10 pairs, only abaxially prominent, separated by 0–2 conspicuous intersecondary veins. Inflorescence (fruiting) 2.0–2.5 × ca. 1.5 cm, racemose, axillary, 7–16-flowered; rachis terete or ± compressed, ± glabrous; pedicels articulate, terete, glabrous, up to 6.5 mm long; bracteoles ± ovate, apically obtuse or acute, 0.6–0.8 × ca. 0.6 mm, ciliolate, abaxially sparsely pubescent. Sepals 4, persistent in fruit, 2.0–2.6 × 1.3–1.6 mm, ovate or obovate, apically ± obtuse, ciliolate on the margin; petals and stamens unknown. Ovary 2-locular; styles 2, 1.3–1.8 mm long; stigmas obliquely subpeltate. Fruit 8.0–9.0 × 6.0–7.5 mm, subglobose, longitudinally striate, glabrous, with rounded apex; seeds 6.5–7.0 × 4.5–5.0 mm, subglobose to ovate, densely villous.

Distribution. Venezuela, Amazonas (Dpto. Río Negro).

Quiina brevensis Pires closely resembles *Q. yatuensis* in leaf and stipule shape. However, leaf texture, number of secondary veins (*Q. brevensis*: 9–

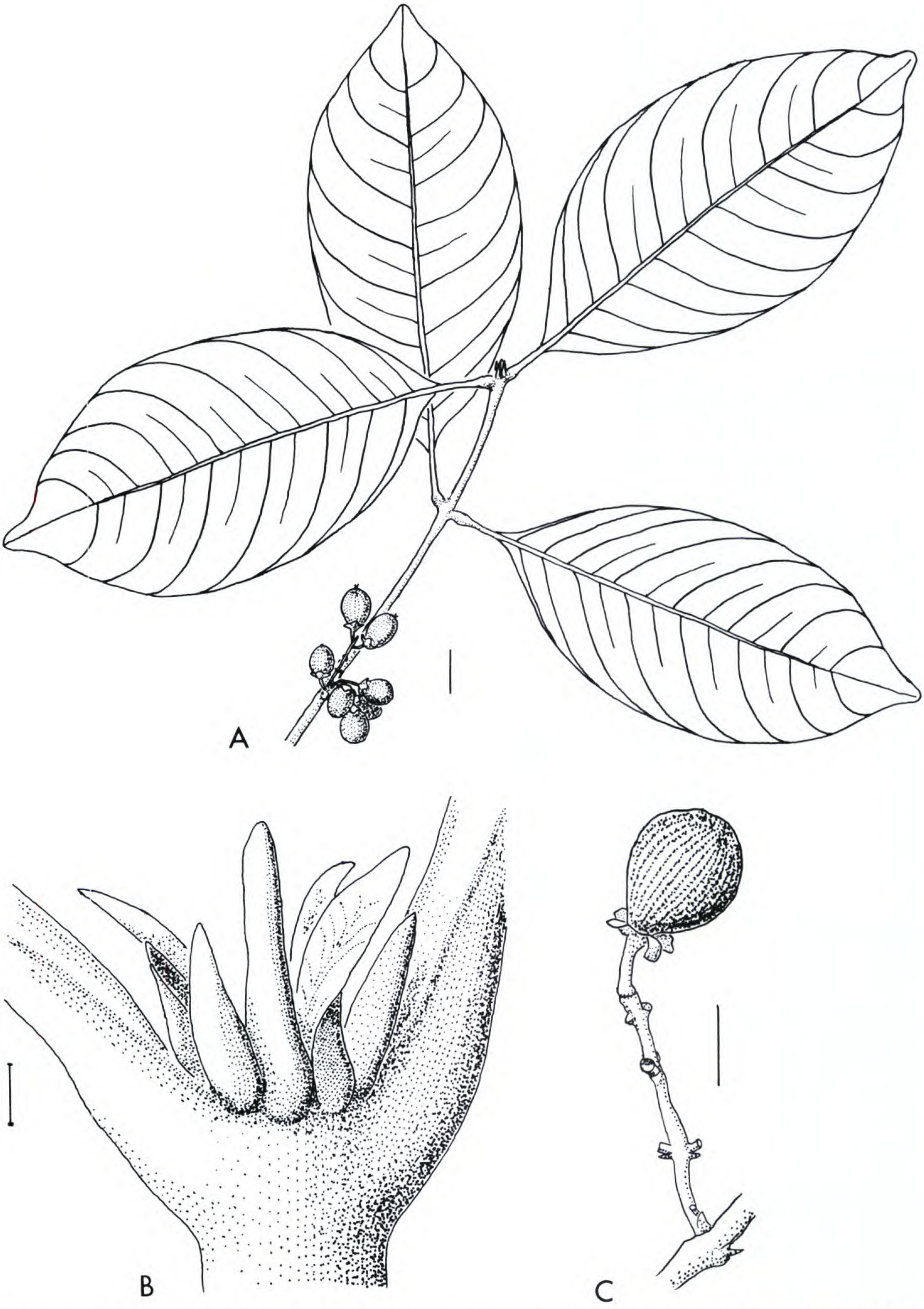


Figure 1. *Quiina yatuensis* Julio Schneider & Zizka. —A. Fruiting branch. —B. Stipules and bracts at terminal bud. —C. Inflorescence with one fruit (scale: A = 1 cm, B = 1 mm, C = 5 mm). Drawings from *Velazco 1413* (by J. Schneider).

15, *Q. yatuensis*: 8–10), and inflorescence structure are different (*Q. brevensis*: lateral branches 1–5-flowered; *Q. yatuensis*: inflorescence apparently unbranched, rarely with one branch from the very base). Because up to now *Q. brevensis* is known only from staminate specimens, its fruit shape is unknown.

Leaf shape and texture as well as stipule shape of *Q. yatuensis* are similar to *Q. rigidifolia* Pires, which is distinguished by having inflorescences with more flowers (*Q. yatuensis*: 7–16, *Q. rigidifolia*: 25– >30), a broader rachis (*Q. yatuensis*: 0.7–1.0 mm, *Q. rigidifolia*: 1.2–2.0 mm), distinctly larger fruits (*Q. yatuensis*: 8.0–9.0 × 6.0–7.5 mm, *Q. rigidifolia*: ca. 3 × 2.5 cm), and a more conspicuously revolute leaf margin.

Froesia gereauana Julio Schneider & Zizka, sp. nov. TYPE: Venezuela. T. F. Amazonas: Dpto. Atures, Lomas graníticas, Caño Piedra, 115 km al SE de Pto. Ayacucho, 4°54′N, 66°54′W, 1500 m a.s.l., sep. 1989, *Fernandez, A., Sanoja, E. & Yanez, M. 5982* (holotype, MO 3948561; isotype, PORT). Figure 2.

Arbor 9–12 m alta. Folia 27-foliolata; stipulis incognitis; petiolulis (5–)9–18 × 2.0–2.7 mm; foliolis oblongis vel ovatis, acuminatis, 24–31 × 6.5–9.0 cm, coriaceis, supra glabris nitidisque, infra praeter trichomata inconspicuos secus nervos secundarios glabris; nervis secundariis (27–)40–57-jugatis, inter se 4–6(–7) mm distantibus; margine ad basim integro, ad apicem crenulato-serrulato. Inflorescentia terminalis, erecta; axe subcylindrico, crasso, piloso; pedicellis ad basim articulatis. Flos hermaphroditus; sepalis 5, 7–8 mm longis, in fructu persistentibus, suborbicularibus, extus pilosis, intus pilosulis; petalis non suppetentibus; staminibus numerosis. Fructus follicularis, 1.7–2.0 × ca. 1.5 cm, ex carpellis maturis 1–3 constans; pericarpio fibroso; seminibus subglobosis vel ellipsoideis, nigris, ca. 1.4 × ca. 1.2 cm.

Haec species a *Froesia venezuelensi* numero distantiaque nervorum secundariorum, foliolorum textura et margine basi integro, apicem versus minus conspicue crenulato-serrulato differt.

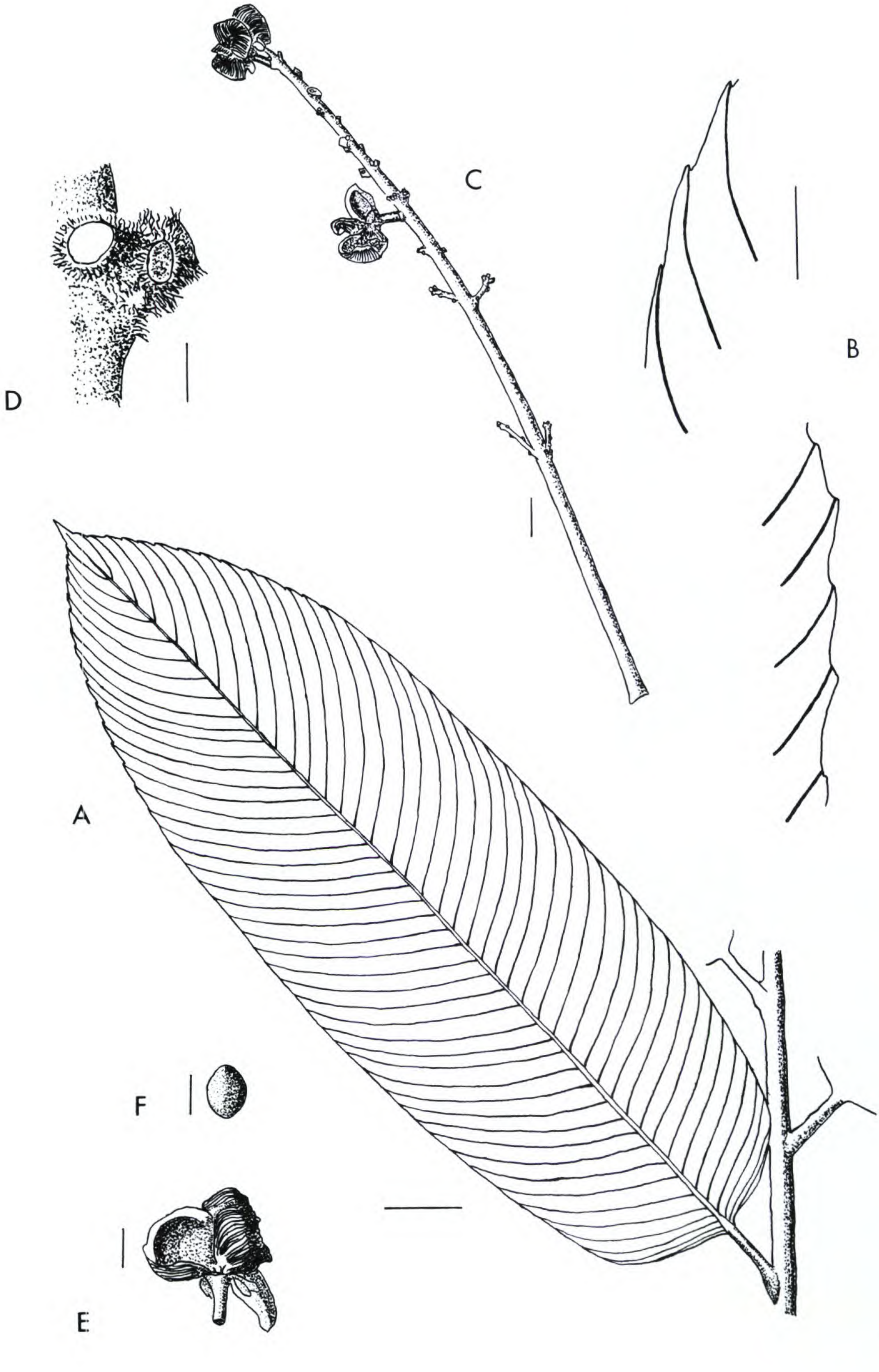
Trees 9–12 m tall, unbranched. Leaves crowded at stem apex; stipules unknown; petiole over 30 cm long, 1.0–1.2 cm thick at base, lenticellate, inconspicuously and shortly pilose; leaflets ca. 27, (1.8–)2.2–5.0 cm apart; petiolule (5–)9–18 × 2.0–2.7 mm, opposite to alternate; blade 24–31 × 6.5–9.0 cm (leaflets of fourth and fifth pair from apex 26–31 × 7.5–9.0 cm, terminal leaflet ca. 24 × 7.5–8.5 cm), coriaceous, oblong to ovate, acuminate, rounded and ± asymmetric at base, adaxially glabrous and glossy, abaxially glabrous on surface, inconspicuously hairy on secondary veins; margin apically ± crenulate-serrulate, basally entire; venation craspedodromous, (27–)40–57 pairs of secondary veins (apical leaflets (27–)43–57, terminal leaflet 40–43), 4–6(–7) mm apart; tertiary veins percurrent, numerous, forming an s-shaped curve, parallel and densely spaced (terminology after Hickey, 1979). Inflorescence terminal, thyrsoid, branches of second order usually short, thus the flowers appearing ± fascicled at the branches of first order; rachis lenticellate, densely villous with short brownish trichomes. Primary bracts ca. 5.0 × 2.5 mm, narrowly triangular, acute, pilose abaxially; bracteoles ca. 2.5 × 1.0 mm; similar to primary bracts in shape and indumentum but smaller; pedicels densely pilose, articulated at base. Flowers bisexual; sepals 5, 7–8 mm long, suborbicular, unequal, persistent and reflexed in fruit, pilose abaxially, pilosulous adaxially; petals unknown; stamens numerous, the filaments filiform, 5–6 mm long, the anthers ellipsoid, ca. 0.8 × 0.4 mm. Fruit composed of 1–3 fully developed follicles (up to 2 carpels aborting); follicles 1.7–2.0 × ca. 1.5 cm when ripe, ± globose to pyriform, the surface shortly pilose, longitudinally furrowed; pericarp fibrous, hard, opening with a longitudinal slit; seed 1 per follicle, ca. 1.4 × 1.2 cm, ± globose, black.

Distribution. Venezuela, Amazonas (Dpto. Atures).

Differentiation of the species of *Froesia* principally relies on leaf characters; in the reproductive parts, no character seemed reliable enough to us to discern the species (and knowledge of variability in floral parts is especially scarce). Texture, indumentum, and margin of leaflets as well as their number and distance between secondary veins seem to be especially helpful. *Froesia gereauana* approaches *F. venezuelensis*, differing from the latter in more strongly indurated leaflets with apically less conspicuously crenate-serrate margins, and especially

→

Figure 2. *Froesia gereauana* Julio Schneider & Zizka. —A. Rachis of leaf with leaflet from apical part of leaf. —B. Leaflet margin near apex. —C. Branch of inflorescence with fruits. —D. Branchlet of inflorescence with basal parts of pedicels. —E. Fruit with two ripe opened follicles, 1 carpel aborted; the sepals are persistent and reflexed in fruit. —F. Seed (scale: A = 2 cm, B = 4 mm, C = 2 cm, D = 2 mm, E, F = 1 cm). Drawings from *Fernandez, Sanoja & Yanez 5982* (by J. Schneider).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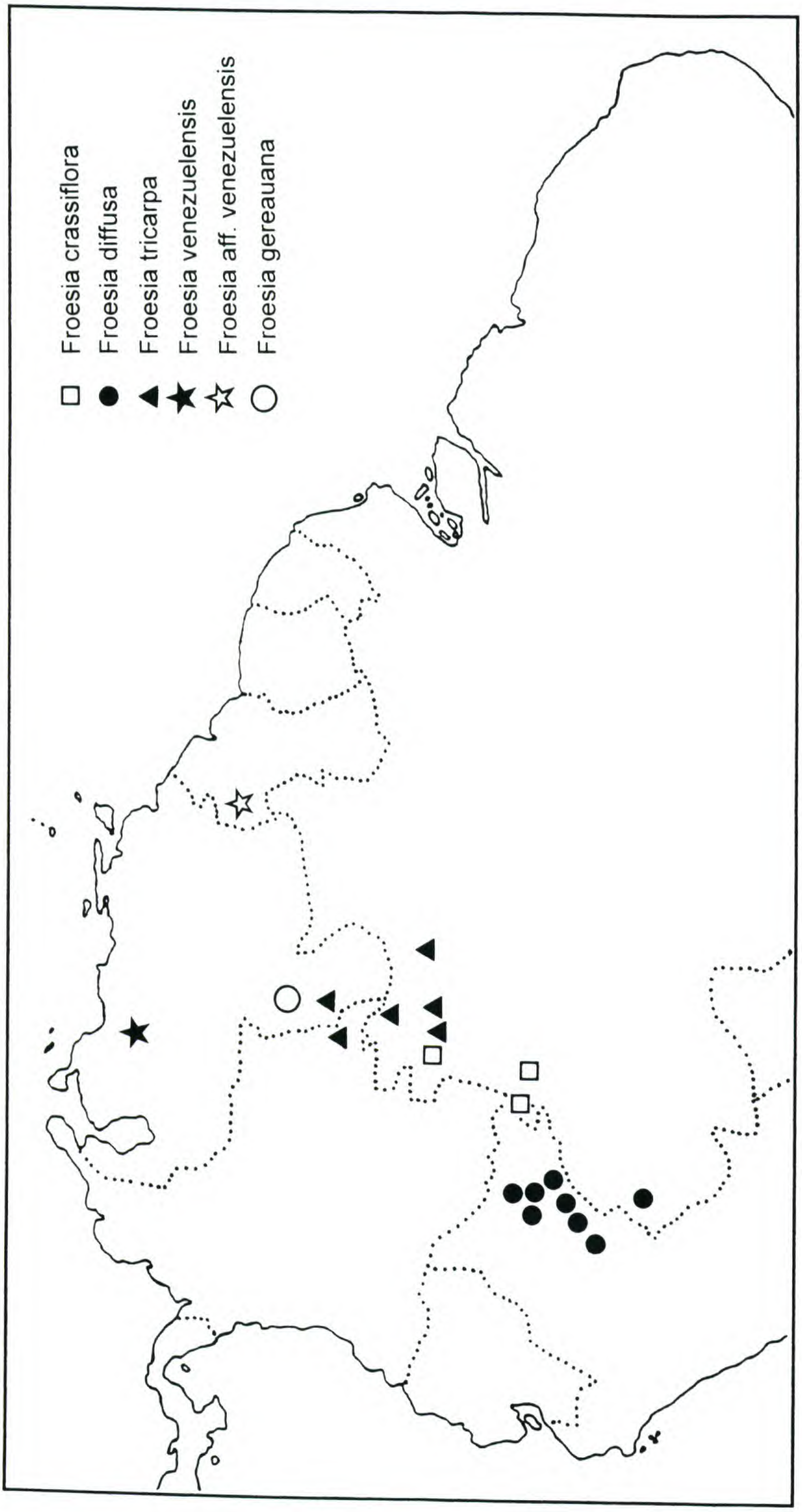

Figure 3. Distribution of *Froesia* species (map by M. Middeke).

in more numerous and less distant secondary veins per leaflet.

The species is named after Roy E. Gereau, who had annotated the type specimen as a potentially new species.

The Genus *Froesia* Pires

Since the description of *Froesia tricarpa* Pires and *F. crassiflora* Pires & Fróes (Pires, 1948, 1950), two comparatively recent publications have dealt with the genus *Froesia* (Steyermark & Bunting, 1975; Gereau & Vásquez, 1994), adding to it the new species *F. venezuelensis* Steyermark & G. S. Bunting and *F. diffusa* Gereau & Rod. Vásquez. Besides the apocarpous gynoecium, the genus is unique in the family in having bisexual flowers, glabrous seeds, a peculiar wood anatomy (Gottwald & Parameswaran, 1967), and interpetiolar stipules divided into 4–6 setose, acute parts. Nevertheless, leaf venation and anatomy display striking similarities to other Quiinaceae and justify maintaining *Froesia* within the family.

In contrast to the two easily separated species of *Touroulia* (the other genus of the Quiinaceae displaying a caulirosulate habit), *Froesia* species form a close-knit group of morphologically and anatomically allied taxa, differing principally in plant and leaf size, texture, shape, venation and indumentum of leaflets, as well as indumentum of follicles.

Three *Froesia* species have a limited distribution in the Amazonian lowlands: *F. crassiflora*: Colombia, Brazil; in caatinga formations or on sandy banks bordering swampy forests (Steyermark & Bunting, 1975). *Froesia diffusa*: Peru, Brazil, 100–200 m a.s.l.; primary lowland forests on clayey soils ("suelos arcillosos") in western Amazonia. *Froesia tricarpa*: Colombia, Venezuela, Brazil, 120–300 m a.s.l.; in savanna and dwarf caatinga forests. *Froesia venezuelensis* is restricted to cloud forests in northern Venezuela, 1000–1300 m a.s.l.; the newly described *F. gereauana* occurs at even higher elevations (1500 m) in the Venezuelan Guayana. An isolated collection from Guiana, upper Mazaruni River Basin, 1220 m a.s.l. (*Tillett, Tillett & Boyan 45131*; K, NY) is at present regarded as conspecific with *F. venezuelensis* (Fig. 3).

Key to the Species of *Froesia*

1. Lower surface of leaves densely pilosulous to puberulous . . . . . *Froesia crassiflora* Pires & Fróes
1′. Lower surface of leaves glabrous, sometimes with inconspicuous short rigid hairs pointing toward apex on and along the secondary veins 2
2(1). Leaflets 11–15 3
2′. Leaflets 17–ca. 27 4
3(2). Petiole 33–54 cm long; leaflets 13–21, basally subcrenate to entire, apically serrulate, chartaceous, 21–32 × 7.5–11.5 cm, (21–)26–38 pairs of secondary veins; leaves 104–133 cm long . . . . . *Froesia venezuelensis* Steyermark & G. S. Bunting
3′. Petiole 10–29 cm long; leaflets 11–15, serrate, even at base, chartaceous to coriaceous, (10–)16–26 × 5–9 cm, 18–29(–31) pairs of secondary veins; leaves 40–100 cm long . . . . . *Froesia tricarpa* Pires
4(2). Leaflets coriaceous, with (27–)40–57 pairs of secondary veins, these 4–6(–7) mm apart . . . . . *Froesia gereauana* Julio Schneider & Zizka
4′. Leaflets chartaceous, with 17–38 pairs of secondary veins, these 6–10(–14) mm apart 5
5(4). Leaflets basally subcrenate to entire, apically serrulate, margins flat; terminal leaflet 24–29 cm long; inflorescence up to ca. 42 cm long (northern Venezuela; Guiana?) . . . . . *Froesia venezuelensis* Steyermark & G. S. Bunting
5′. Leaflets basally entire, apically ± subcrenate, margins ± crisp (when dry), terminal leaflet 15–23 cm long; inflorescence 80–120 cm long (western Brazil, Peru) . . . . . *Froesia diffusa* Gereau & Rod. Vásquez

Investigated specimens. **Froesia crassiflora** Pires & Fróes: COLOMBIA: *Schultes & López 10401c* (US). BRAZIL: *Fróes 24056* (F, K), *28194* (NY), *Schultes & López 9818* (US). **Froesia diffusa** Gereau & Rod. Vásquez: PERU: *Vásquez, Arévalo & Jaramillo 7538* (MO, NY), *7731* (MO); *Vásquez & Jaramillo 3198* (NY), *6791* (MO, NY), *7252* (MO, NY), *9629* (MO); *Vásquez, Ortíz & Jaramillo 14124* (US); *Vásquez, Ruiz & Jaramillo 6555* (G, MO, NY); *Vásquez & Soto 11874* (G, MO, NY). BRAZIL: *Prance et al. 12455* (K, MO, S, US). **Froesia gereauana** Julio Schneider & Zizka: VENEZUELA: *Fernandez, Sanoja & Yanez 5982* (MO, PORT). **Froesia tricarpa** Pires: BRAZIL: *Fróes 22810* (F), *28290* (S); *Maas et al. 6833* (NY); *Nascimento, Pires & Coradin 148258* (MO); *Pires 944* (F, US); *Pires & Marinho 15671* (MO); *Schultes & López 9555* (K, NY, US), *9682* (US). COLOMBIA: *Schultes, Baker & Cabrera 18152* (US). VENEZUELA: *Bunting, Akkermans & van Rooden 3947* (U, VEN). **Froesia venezuelensis** Steyermark & G. S. Bunting: VENEZUELA: *Schneider 1* (FR, VEN), *2* (FR, VEN); *Steyermark & Bunting 105237* (K, NY, US, VEN), *105246* (NY, US, VEN); *Steyermark, Bunting & Wessels-Boer 100282* (NY, S, VEN). **F. aff. venezuelensis:** GUIANA: *Tillett, Tillett & Boyan 45131* (K, NY).

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Novae Gesneriaceae Neotropicarum VII: New Combinations

Laurence E. Skog
Department of Botany, NHB-166, U.S. National Museum of Natural History,
Smithsonian Institution, Washington, D.C. 20560-0001, U.S.A.

Lars P. Kvist
Unit of Forestry, Royal Veterinary and Agricultural University,
DK-1871 Frederiksberg C (Copenhagen), Denmark

ABSTRACT. Study of Gesneriaceae for the *Flora of Ecuador* and the *Catalogue of the Vascular Plants of Ecuador* has shown that some recently published new species need to be transferred with new combinations in *Columnea*: *C. filifera*, *C. katzensteinii*, *C. mastersonii*, *C. medicinalis*, *C. ornata*, and *C. tandapiana*, or included as synonyms of previously published species.

In early 1993 we published a revision of the genus *Columnea* for Ecuador (Kvist & Skog, 1993). While the 1993 paper was delayed in press by the unfortunate occurrence of Hurricane Iniki in Hawaii, another paper appeared (Wiehler, 1992) that dealt in part with some of the same species that we were describing as new, with names for some of these species under generic names that we consider to be synonyms of *Columnea*. Therefore, we are here making new combinations for some of the species published in 1992 just prior to our publication. In 1995 additional new species of *Columnea* and other genera were published by Wiehler, along with further discussion and citation of additional specimens for some of the species published as new in his 1992 paper. We are here making new transfers into *Columnea* for some of the species occurring in Ecuador and nearby countries published by Wiehler in 1992 and 1995. In most cases we have not seen the holotypes or isotypes because so far as we can determine the specimens have not yet been distributed from GES. However, some of the specimens that we cite as types or representative material in our 1993 paper were cited by Wiehler in his 1992 and 1995 papers. In addition, some of the specimens Wiehler cited in his papers we had also seen. For some of the other species of which we have not seen the types, we are confident from our reading of the descriptions that the species described belong to *Columnea* or other genera and are here making the transfers or new combinations. Still other species from these papers require future study before we can determine their status.

Some of the new species published by Wiehler in 1992 had been transferred to *Columnea* in the interim before the 1995 papers appeared. However, no mention is made by Wiehler (1995a, 1995b) of the new species or combinations published in 1993 by Smith and Skog or in 1994 by Smith.

Columnea filifera (Wiehler) L. E. Skog & L. P. Kvist, comb. nov. Basionym: *Dalbergaria filifera* Wiehler, Phytologia 73: 224. 1992; Gesneriana 1: 39. 1995. TYPE: Ecuador. Esmeraldas: near new road from Lita and Alto Tambo towards San Lorenzo, *Wiehler & GRF Expedition 9033* (holotype, GES not seen; isotypes, QCA, US none seen).

Columnea fililoba L. P. Kvist & L. E. Skog, Allertonia 6: 356. 1993. TYPE: Ecuador. Carchi: San Marcos, *Kvist, Barfod & Nissen 48997* (holotype, AAU; isotypes, QCA, QCNE, US).

Wiehler (1995a: 39) included our 1993 species as a synonym under his *Dalbergaria filifera*. We agree that the species are synonymous and are therefore making a new combination in *Columnea*.

Columnea katzensteinii (Wiehler) L. E. Skog & L. P. Kvist, comb. nov. Basionym: *Pentadenia katzensteinii* Wiehler, Phytologia 73: 235. 1992; Gesneriana 1: 75. 1995. TYPE: Ecuador. Morona–Santiago: Cordillera del Boliche, ca. 60 km from Limón, *Wiehler & GRF Expedition 88128* (holotype, GES not seen; isotypes, F, K, MO, NY, QCA, US none seen).

Columnea lavandulacea L. P. Kvist & L. E. Skog, Allertonia 6: 387. 1993. TYPE: Ecuador. Pichincha: Quito–Santo Domingo de los Colorados road, *Kvist & Barfod 49066* (holotype, AAU).

Duplicates of a specimen cited by Wiehler (1995a: 75) were seen and cited by us as paratypes

(*Steyermark 52572* (F, MO, US)) of *Columnea lavandulacea*, which he cited as a synonym of *Pentadenia katzensteinii*. We agree that the species are the same and are here making a new combination in *Columnea*.

Columnea mastersonii (Wiehler) L. E. Skog & L. P. Kvist, comb. nov. Basionym: *Dalbergaria mastersonii* Wiehler, Phytologia 73: 225. 1992; Gesneriana 1: 43. 1995. TYPE: Ecuador. Pichincha: cloud forest of Tandápi, near village of Cornejo Astorga (Tandápi), *Wiehler & Masterson 7968* (holotype, GES not seen; isotypes, SEL, NY not seen, QCA not seen, U not seen, US not seen).

Columnea cinerea L. P. Kvist & L. E. Skog, Allertonia 6: 351. 1993. TYPE: Ecuador. Pichincha: along Río Guayllabamba, Nuevo Azuay, *Holm-Nielsen, Jaramillo & Coello 24587* (holotype, AAU; isotype, US).

Some specimens cited by Wiehler (1995a: 43) were seen and cited by us as paratypes: *Gentry & Schupp 26651* (MO, US). In addition, *Columnea cinerea* was included as a synonym of *Dalbergaria mastersonii* by Wiehler (1995a). We saw an isotype of *D. mastersonii* from SEL and had included it as a paratype in our paper in 1993, therefore we are making a new combination in *Columnea*.

Columnea medicinalis (Wiehler) L. E. Skog & L. P. Kvist, comb. nov. Basionym: *Dalbergaria medicinalis* Wiehler, Phytologia 73: 226. 1992; Gesneriana 1: 45. 1995. TYPE: Ecuador. Pichincha: above Chiriboga, on old road from Quito to Santo Domingo, *Wiehler & GRF Expedition 88215* (holotype, GES not seen; isotypes, K, MO, NY, QCA, SEL, US none seen).

Columnea densibracteata L. P. Kvist & L. E. Skog, Allertonia 6: 352. 1993. TYPE: Ecuador. Azuay: Chacanceo–Molleturo road, between Río Blanco and Río Norcay, *Steyermark 52826* (holotype, US; isotype, F).

Some of the specimens cited by Wiehler (1995a: 45) had already been included by us either as the type of *Columnea densibracteata* (*Steyermark 52826*) or as paratypes: *Mexia 8412* (MO, U, US). Our species, *Columnea densibracteata*, was included as a synonym of *Dalbergaria medicinalis* by Wiehler.

Columnea ornata (Wiehler) L. E. Skog & L. P. Kvist, comb. nov. Basionym: *Dalbergaria ornata* Wiehler, Phytologia 73: 227. 1992; Gesneriana 1: 47. 1995. TYPE: Cultivated material grown in GRF greenhouses as G-2665 from live material collected in Costa Rica by John Hall in 1979, *Wiehler 87105* (holotype, GES not seen; isotypes, CR, SEL none seen).

Although *Columnea ornata* is not from Ecuador, examination of specimens cited by Wiehler (1995a: 47) as additional material (*Skutch 4780* (F, US)) shows this species to be *Columnea*, and we make a new combination in *Columnea* here. An additional collection near the site of the Skutch collection at ca. 1 mile beyond the divide between San Isidro del General and the coastal town of Dominical, 900 m, Prov. San José, Costa Rica, *Croat 35314* (MO, US) is this same species.

Columnea tandapiana (Wiehler) L. E. Skog & L. P. Kvist, comb. nov. Basionym: *Pentadenia tandapiana* Wiehler, Phytologia 73: 238. 1992; Gesneriana 1: 84. 1995. TYPE: Ecuador. Pichincha: 7 km from San Miguel de los Bancos on road to Mindo, *Wiehler & GRF Expedition 90133* (holotype, GES not seen; isotypes, QCA, US none seen).

Columnea inconspicua L. P. Kvist & L. E. Skog, Allertonia 6: 385. 1993. *Pentadenia inconspicua* (L. P. Kvist & L. E. Skog) Wiehler, Gesneriana 1: 122. 1995. TYPE: Ecuador. Pichincha: Tandápi, confluence between Río Tandápi with Río Pilatón, *Sparre 17761* (holotype, S).

It is unclear to us what Wiehler intended to do with *Columnea inconspicua* for on p. 84 of his (1995a) publication the species was included as a synonym of *Pentadenia tandapiana* Wiehler, but on p. 122 (Wiehler, 1995b) the species was cited as the basionym of a new combination in *Pentadenia*. Since the holotype of *Columnea inconspicua* was included among specimens examined for *Pentadenia tandapiana*, we have included the synonym there.

Some of the names that appear in the 1992 and 1995 Wiehler publications will be included in the *Flora of Ecuador*, the *Catalogue of the Vascular Plants of Ecuador*, and elsewhere as synonyms of previously published taxa. We list these names below and comment on those taxa being included as heterotypic synonyms.

Columnea filipendula Wiehler, Phytologia 73: 222. 1992; Gesneriana 1: 33. 1995 = *Columnea rubricaulis* Standley, Field Mus. Publ. Bot. 17: 393. 1938.

Both *Columnea filipendula* and *C. rubricaulis* were originally described from nearby localities in Honduras, and it is remarkable that in the protologue Wiehler did not compare his new species with *C. rubricaulis*, instead comparing *C. filipen-*

dula with *C. linearis* Oersted from Costa Rica, and *C. purpusii* Standley and *C. erythrophaea* Decaisne both described from Mexico. The ternate leaves and slender pedicels of *C. filipendula* can also be seen in specimens of *C. rubricaulis* from Honduras and Nicaragua, and although no examples of the type specimen have been seen by us, no characters in the description of *C. filipendula* appear to distinguish the species from numerous collections of *C. rubricaulis*. The first author recently traveled to Honduras and saw *C. rubricaulis* in La Muralla National Park growing at a similar altitude and in a similar habitat as described for *C. filipendula*, reinforcing the belief that the species are synonymous.

Dalbergaria albiflora (L. P. Kvist & L. E. Skog) Wiehler, Gesneriana 1: 121. 1995 ≡ *Columnea albiflora* L. P. Kvist & L. E. Skog, Allertonia 6: 348. 1993.

Dalbergaria cappilosa [sic] (L. P. Kvist & L. E. Skog) Wiehler, Gesneriana 1: 121. 1995 ≡ *Columnea capillosa* L. P. Kvist & L. E. Skog, Allertonia 6: 349. 1993.

Dalbergaria evolvens Wiehler, Phytologia 73: 223. 1992; Gesneriana 1: 37. 1995 = *Columnea guttata* Poeppig, in Poeppig & Endlicher, Nov. Gen. et Sp. Pl. 3: 1. 1840.

We have compared the description of *Dalbergaria evolvens* with the holotype of *Columnea guttata* (*Poeppig D1481* at W), as well as other specimens of the species, and believe that *D. evolvens* falls within the limits of the older taxon. We had already in 1993 included as a synonym of *C. guttata*, *D. madisonii* Wiehler with which Wiehler compared his new species. *Columnea guttata*, like *D. evolvens*, has leaves with contrasting red tips, nearly sessile flowers with similar calyx lobes, and an unequal corolla limb, among other similar characters. Both species are known from Napo province in Ecuador, although *C. guttata* was originally described from Peru.

Dalbergaria fuscihirta (L. P. Kvist & L. E. Skog) Wiehler, Gesneriana 1: 121. 1995 ≡ *Columnea fuscihirta* L. P. Kvist & L. E. Skog, Allertonia 6: 358. 1993.

Dalbergaria gigantifolia (L. P. Kvist & L. E. Skog) Wiehler, Gesneriana 1: 121. 1995 ≡ *Columnea gigantifolia* L. P. Kvist & L. E. Skog, Allertonia 6: 360. 1993.

Dalbergaria incredibilis (L. P. Kvist & L. E. Skog) Wiehler, Gesneriana 1: 43. 1995 ≡ *Columnea incredibilis* L. P. Kvist & L. E. Skog, Nordic J. Bot. 8: 253. 1988.

Dalbergaria longinervosa (L. P. Kvist & L. E. Skog) Wiehler, Gesneriana 1: 121. 1995 ≡ *Columnea longinervosa* L. P. Kvist & L. E. Skog, Allertonia 6: 363. 1993.

Dalbergaria nematoloba (L. P. Kvist & L. E. Skog) Wiehler, Gesneriana 1: 121. 1995 ≡ *Columnea nematoloba* L. P. Kvist & L. E. Skog, Brittonia 44: 479. 1992.

Dalbergaria purpurimarginata (L. P. Kvist & L. E. Skog) Wiehler, Gesneriana 1: 121. 1995 ≡ *Columnea purpurimarginata* L. P. Kvist & L. E. Skog, Allertonia 6: 365. 1993.

Dalbergaria rubribracteata (L. P. Kvist & L. E. Skog) Wiehler, Gesneriana 1: 122. 1995 ≡ *Columnea rubribracteata* L. P. Kvist & L. E. Skog, Allertonia 6: 368. 1993.

Dalbergaria variabilis Wiehler, Gesneriana 1: 51. 1995 = *Columnea rubriacuta* (Wiehler) L. P. Kvist & L. E. Skog, Allertonia 6: 367. 1993.

Although we have seen neither the type specimens of *Dalbergaria variabilis*, nor some of the additional specimens examined cited with this species as being at US (apparently not yet distributed from GES), a few that were cited had been seen by us and annotated before our 1993 publication as *Columnea rubriacuta*. Based on the specimens we have seen and the description of *D. variabilis*, we believe that this species is a synonym of *C. rubriacuta*.

Pentadenia ovatifolia (L. P. Kvist & L. E. Skog) Wiehler, Gesneriana 1: 122. 1995 ≡ *Columnea ovatifolia* L. P. Kvist & L. E. Skog, Allertonia 6: 393. 1993.

Pentadenia hypocyrtantha Wiehler, Phytologia 73: 234. 1992; Gesneriana 1: 74. 1995 ≡ *Columnea hypocyrtantha* (Wiehler) J. F. Smith & L. E. Skog, Novon 3: 190. 1993.

Pentadenia manabiana Wiehler, Phytologia 73: 236. 1992; Gesneriana 1: 77. 1995 ≡ *Columnea manabiana* (Wiehler) J. F. Smith & L. E. Skog, Novon 3: 189. 1993.

Pentadenia rileyi Wiehler, Phytologia 73: 236. 1992; Gesneriana 1: 79. 1995 ≡ *Columnea rileyi* (Wiehler) J. F. Smith, Syst. Bot. Monogr. 44: 68. 1994.

Pentadenia rubriacuta Wiehler, Phytologia 73: 237. 1992; Gesneriana 1: 81. 1995 (not *Columnea rubriacuta* L. P. Kvist & L. E. Skog) = *Columnea spathulata* Mansfeld, Notizbl. Bot. Gard. Berlin-Dahlem 14(121): 37. 1938.

Again, we have not seen any of the type specimens as they probably have not yet been distributed from GES. However, of the five collections cited as additional material examined for *Pentadenia*

rubriacuta, four of the collections had previously been seen by us, and were cited by Smith (1994) as representing *Columnea spathulata*.

Rhoogeton panamensis Wiehler, Phytologia 73: 239. 1992; Gesneriana 1: 88. 1995 = *Paradrymonia pedunculata* L. E. Skog, Brittonia 30: 325. 1978.

Living material of this taxon and source of the type specimens has been in cultivation since 1978. We have seen and identified living plants as *Paradrymonia pedunculata*, which has a range from eastern Costa Rica to southern Chocó in Colombia and is well within the range of the genus *Paradrymonia*. The genus *Rhoogeton* has a range apparently restricted to the Guayana highlands of Venezuela and Guyana. An additional specimen, "*Biolley 343* or *Pittier & Durand 2654*," cited by Wiehler as being at US has not been found, but *Biolley 2654* at BR, believed to be part of the same gathering, was seen and identified as *Paradrymonia pedunculata*.

Trichantha fimbricalyx (L. P. Kvist & L. E. Skog) Wiehler, Gesneriana 1: 122. 1995 ≡ *Columnea fimbricalyx* L. P. Kvist & L. E. Skog, Allertonia 6: 373. 1993.

Trichantha laevis (L. P. Kvist & L. E. Skog) Wiehler, Gesneriana 1: 122. 1995 ≡ *Columnea laevis* L. P. Kvist & L. E. Skog, Allertonia 6: 376. 1993.

Trichantha minutiflora (L. P. Kvist & L. E. Skog) Wiehler, Gesneriana 1: 122. 1995 ≡ *Columnea minutiflora* L. P. Kvist & L. E. Skog, Allertonia 6: 379. 1993.

Trichantha rubricalyx (L. P. Kvist & L. E. Skog) Wiehler, Gesneriana 1: 122. 1995 ≡ *Columnea rubricalyx* L. P. Kvist & L. E. Skog, Allertonia 6: 380. 1993.

Trichantha tenella Wiehler, Gesneriana 1: 95. 1995 = *Columnea tenella* L. P. Kvist & L. E. Skog, Allertonia 6: 380. 1993.

This last species requires some discussion and clarification as it has the same epithet as a previously described species of *Columnea*. *Columnea tenella* L. P. Kvist & L. E. Skog was published in 1993 as a new name for *Trichantha gracilis* Wiehler (Selbyana 7: 339. 1984), not *Columnea gracilis* (Martius) O. Kuntze [basionym: *Hypocyrta gracilis* Martius; ≡ *Codonanthe gracilis* (Martius) Hanstein], since the epithet could not be transferred to *Columnea*. The new species, *Trichantha tenella* Wiehler, is based on a different type from *Trichantha gracilis* Wiehler and *Columnea tenella* L. P. Kvist & L. E. Skog. We believe *Trichantha tenella* Wiehler to be a synonym of our earlier *Columnea tenella* L. P. Kvist & L. E. Skog. Although we have not seen the holotype of *Trichantha tenella* Wiehler, one of the paratypes (*Madison & Besse 7011* at SEL) is clearly *Columnea tenella* L. P. Kvist & L. E. Skog and was cited as such in 1993.

Finally, to prevent new combinations from being recorded incorrectly, we should note here that the following two combinations that appear as new (Wiehler, 1995a, b) had been published previously:

Corytoplectus pulcher (N. E. Brown) Wiehler, Gesneriana 1: 37. 1995 [as comb. nov.] = *Corytoplectus pulcher* (N. E. Brown) Wiehler, Selbyana 5: 61. 1978.

Paradrymonia longipetiolata (J. D. Smith) Wiehler, Gesneriana 1: 122. 1995 [as comb. nov.] = *Paradrymonia longipetiolata* (J. D. Smith) Wiehler, Selbyana 5: 54. 1978 ("longipedunculata").

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A New Species and New Combinations in *Calibrachoa* (Solanaceae)

João Renato Stehmann and João Semir

Departamento de Botânica, Instituto de Biologia, Universidade Estadual de Campinas, C.P. 6109, CEP 13091-170, Campinas, SP, Brazil

ABSTRACT. We describe and illustrate a new species of *Calibrachoa* (Solanaceae) from the state of Santa Catarina in southern Brazil. *Calibrachoa eglandulata* is distinguished by the presence of eglandular trichomes, relatively long stamens and corolla tubes, lobed stigmas, and pendent branches. The eglandular trichomes are unique to this species. We also propose nine new combinations in *Calibrachoa*.

Calibrachoa La Llave & Lexarza is an American genus of Solanaceae with a center of diversity in southern Brazil. Historically, *Calibrachoa* has been included in *Petunia* Jussieu due to morphological similarity. Wijsman and Jong (1985) recognized the two genetically isolated groups of species in *Petunia* as different genera. *Petunia* contained the species group with a diploid number of 14 chromosomes and those related to the garden Petunia, while *Calibrachoa* retained the species group with 18 chromosomes (Brummitt, 1989). *Calibrachoa* species are characterized by woody stems, conduplicate aestivation with two petals covering the other three, and seed-coat cells with straight anticlinal walls. *Petunia* species have nonwoody stems, imbricate aestivation, and seed-coat cells with wavy anticlinal walls. Wijsman (1990) transferred most species from *Petunia* to *Calibrachoa*.

We have reviewed the Brazilian species of *Calibrachoa* and *Petunia*, and we propose nine new combinations of Brazilian *Calibrachoa* to complement the nomenclatural combinations started by Wijsman. We also describe a new species of *Calibrachoa*, *C. eglandulata*, which grows in the state of Santa Catarina in southern Brazil.

Calibrachoa eglandulata Stehmann & Semir, sp. nov. TYPE: Brazil. Santa Catarina: Urubici, estrada da Serra do Corvo Branco em direção a Urubici (após subida da Serra), 4 Nov. 1994 (fl, fr), *J. R. Stehmann 1534 & J. Dutilh* (holotype, UEC; isotypes, K, MO). Figure 1A–G.

Species inter omnes pilis eglandulosis distincta. *Calibrachoa linoides* affinis autem non solum ramis pendulis, corollae tubo et stylo maioribus sed etiam stigmate lobato differt.

Decumbent shrub, rarely erect, with simple, eglandular trichomes. *Stems* with woody base, irregularly sulcate, glabrate, elongate branches, sometimes more than 2 m long, pendent, pilose or subvillous, yellowish brown or gray; internodes 3–20 mm long. *Brachyblasts* usually absent. *Leaves* sessile or subsessile, blade 13–25 mm long, 5–11 mm wide, elliptic, less often ovate or obovate, apex acute or obtuse, base shortly and abruptly attenuate, blade slightly asymmetric, plane or concave, margin sometimes slightly revolute and thickened, pilose or subvillous on both faces, on the abaxial side, or only at the margin and midrib, adaxial surface with sunken midrib, abaxial surface with thickened midrib, secondary nerves not evident. *Sympodial units* 1-flowered, with opposite leaf-like bracts, internodes 12–30 mm long, longer than the vegetative internodes. *Pedicels* 17–30 mm long, pilose or subvillous, suberect to patent. *Calyx* 13–19 mm long, greenish, externally villous, internally sparsely pilose, 10-nervate, lobes 5–12 mm long, unequal, narrow-triangular to subulate. *Corolla* with conduplicate aestivation with two petals covering the other three, funnel-shaped, zygomorphic, externally pilose to subvillous, internally glabrous, tube 18–20 mm long, narrow, yellow with dark purple nerves, yellow mouth, limb 23–27 mm diam., magenta, lobes with apex truncate or slightly emarginate. *Stamens* 5, heterodynamous, the free portions 5.5–8 mm, 6–9 mm, and 9–11 mm long, the fused portions 4.5–8 mm long, glabrous, anthers yellow, about 1 mm long. *Ovary* about 1.5 mm long, ovoid, style 11.5–16 mm long, slender, apex curved, stigma lobed. *Capsule* 6–8 mm long, 3.5–5 mm diam., elipsoid to globose, 2-valved, the valve apex mucronate, shortly partite; pedicel 32–35 mm long, strongly deflexed. *Seeds* 0.98–1.04 mm long, ellipsoid, blackish, seed-coat reticulate-foveate with straight thick-walled ridges.

Calibrachoa eglandulata is recognized by the eglandular trichomes, long and pendent branches, long and narrowly funnel-shaped corolla, long filaments, and lobed stigma. *Calibrachoa eglandulata* most closely resembles *C. linoides* (Sendtnet) Wijs-

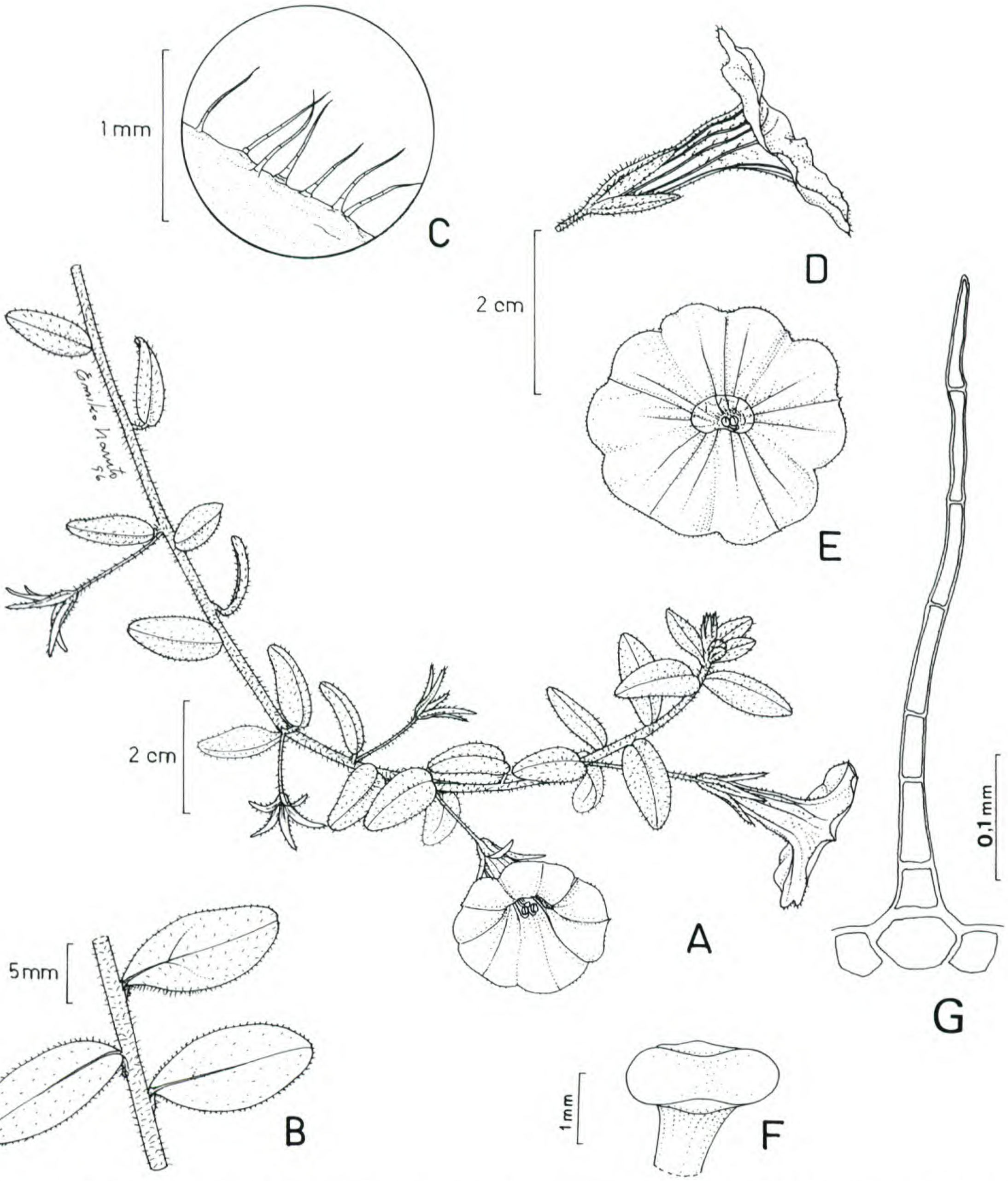

Figure 1. *Calibrachoa eglandulata* Stehmann & Semir (cultivated specimen: progeny of *J. R. Stehmann 1534 & J. Dutilh*, UEC). —A. Habit. —B. Vegetative stem and leaves. —C. Eglandular vestiture. —D. Flower. —E. Corolla. —F. Stigma. —G. Eglandular trichome.

man, a widely dispersed species in Brazil. *Calibrachoa linoides* differs in its erect habit, shorter corolla and stamens, and truncate stigma.

Calibrachoa eglandulata is the only species of the genus with eglandular trichomes. Since glandular trichomes are found in all other species of this genus and the closely related genera *Fabiana* and *Petunia*, trichomes in *C. eglandulata* probably lost the capacity to produce a secretion.

Geographic distribution is restricted to the highlands on the border of the southern Brazilian plateau, in Santa Catarina (> 1200 m elevation). *Calibrachoa eglandulata* grows at the edge of small rocky walls, and the long, pendent branches rest over the shrub vegetation that grows at the base of the rocky walls.

Paratypes. BRAZIL. **Santa Catarina:** Urubici, estrada

para a Serra do Corvo Branco, 6 Dec. 1995 (fl, fr), *J. R. Stehmann 1763, E. L. Borba, A. Ippolito & C. dos Reis* (MBM, UEC); estrada para a Serra do Corvo Branco, 6 Dec. 1995 (fl, fr), *J. R. Stehmann 1764, E. L. Borba, A. Ippolito & C. dos Reis* (UEC); estrada Serra do Corvo Branco, 6 Dec. 1995 (fl, fr), *J. R. Stehmann 1765, E. L. Borba, A. Ippolito & C. dos Reis* (UEC).

Calibrachoa dusenii (R. E. Fries) Stehmann & Semir, comb. nov. Basionym: *Petunia dusenii* R. E. Fries, Kongl. Svenska Vetenskapsakad. Handl. 46(5): 65–66. Tab. 3, fig. 4; tab. 7, fig. 2a–d. 1911. TYPE: Brazil. Paraná: Curitiba, 20 Oct. 1908, *Dusén 6915* (S not seen).

Calibrachoa elegans (Miers) Stehmann & Semir, comb. nov. Basionym: *Petunia elegans* Miers, London J. Bot. 5: 186. 1846. TYPE: Brazil. Minas Gerais: *J. Miers 2483* (lectotype, selected here, BM).

Calibrachoa humilis (R. E. Fries) Stehmann & Semir, comb. nov. Basionym: *Petunia humilis* R. E. Fries, Kongl. Svenska Vetenskapsakad. Handl. 46(5): 44–45. Tab. 6, fig. 1a–b. 1911. TYPE: Uruguay. Dept. Salto: Arapey, 26 Nov. 1894, *C. Osten 3105* (lectotype, selected here, US).

Calibrachoa micrantha (R. E. Fries) Stehmann & Semir, comb. nov. Basionym: *Petunia micrantha* R. E. Fries, Kongl. Svenska Vetenskapsakad. Handl. 46(5): 61–62. Tab. 4, fig. 3; tab. 7, fig. 5a–c. 1911. TYPE: Brazil. Paraná: *Sellow 5045* (B destroyed); Tab. 4, fig. 3 (lectotype, selected here).

Original material of the basionym is missing and was probably destroyed in B. We chose the illustration found in the protologue as the lectotype because it is representative for the species and was based on the type, *Sellow 5045*.

Calibrachoa ovalifolia (Miers) Stehmann & Semir, comb. nov. Basionym: *Petunia ovalifolia* Miers, London J. Bot. 5: 189. 1846. TYPE: Brazil. Rio Grande do Sul: 1835, *Isabelle s.n.* (lectotype, selected here, K).

Calibrachoa sendtneriana (R. E. Fries) Stehmann & Semir, comb. nov. Basionym: *Petunia sendtneriana* R. E. Fries, Kongl. Svenska Vetenskapsakad. Handl. 46(5): 54–55. Tab. 6, fig. 7a–d. 1911. TYPE: Brazil. Santa Catarina: *Sellow 4290* (syntype, B destroyed); Santa Catarina: "am Rande der Serra do Oratório," Feb. 1890, *Ule 1528* (syntype, B destroyed); Santa Catarina: São Joaquim, Bom Jardim da Serra, curral falso, 10 Dec. 1958, *R. Reitz & R. M. Klein 7761* (neotype, selected here, HBR; isoneotypes, B, FLOR, G, K, L, US).

The syntypes of the basionym are missing and were probably destroyed in B; we could not find duplicates of them in any herbaria. The illustration in the protologue could be selected as the lectotype, but it shows only morphological details and is not a good representation of the species. For this reason we have designated a neotype.

Calibrachoa serrulata (L. B. Smith & Downs) Stehmann & Semir, comb. nov. Basionym: *Petunia serrulata* L. B. Smith & Downs, Phytologia 10: 440. Tab. 11, fig. 11; tab. 12, figs. 13–14. 1964. TYPE: Brazil. Santa Catarina: São Joaquim, mountain crest, Bom Jardim, 23 Oct. 1958, *R. Reitz & R. M. Klein 7446* (holotype, US; isotypes, FLOR, HBR).

Calibrachoa spathulata (L. B. Smith & Downs) Stehmann & Semir, comb. nov. Basionym: *Petunia spathulata* L. B. Smith & Downs, Phytologia 10: 440. Tab. 12, figs. 1–2. 1964. TYPE: Brazil. Santa Catarina: Porto União, waste ground, by the road to Matos Costa, 35 km S of Porto União, alt. 1200 m, 20 Dec. 1956, *L. B. Smith & R. Reitz 8907* (holotype, US; isotypes, HBR, R).

Calibrachoa thymifolia (A. St.-Hilaire) Stehmann & Semir, comb. nov. Basionym: *Fabiana thymifolia* A. St.-Hilaire, Pl. Rem. Brés.: 220. Fig. 20. 1824. TYPE: Brazil. Rio Grande do Sul: in pascuis prope praedium dictum Rincao de Sanaloes, 1821, *A. St.-Hilaire s.n.* (holotype, P).

Acknowledgments. The first author was partially supported by a grant received from the Fundação Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES), and this paper is a result in part of his doctoral thesis in development at the Universidade Estadual de Campinas (UNICAMP). We thank the curators of the mentioned herbaria, and Angela B. Martins for reviewing the manuscript and for nomenclatural assistance.

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——— & J. H. Jong. 1985. On the interrelationships of certain species of *Petunia*. IV. Hybridization and nomenclatural consequences in the *Petunia* group. Acta Bot. Neerl. 34: 337–349.

A New Species of *Albizia* Durazzini (Leguminosae Mimosoideae) from Madagascar

Jean-François Villiers
Laboratoire de Phanérogamie, 16 rue Buffon, 75005 Paris, France

ABSTRACT. A new species of *Albizia*, *A. mainaea*, is described from western Madagascar and compared with previously known species.

R. Capuron (1970) indicated the presence of *Albizia gummifera* (J. F. Gmelin) C. A. Smith from all phytogeographic domains of Madagascar. Upon examination of gatherings of this species complex from Madagascar, three species were encountered: *Albizia adianthifolia* (Schumacher) W. Wight from moist forests, *Albizia gummifera* from montane and submontane forests, and a new species from principally tropophyllous forests, which is here described and compared with species previously known in the *Albizia gummifera* complex sensu Brenan (1952).

Albizia mainaea Villiers, sp. nov. TYPE: Madagascar. Prov. Toliara: Imonty, canton Behara, district Androy, 1 Nov. 1949, *Ramakoto 2690 RN* (holotype, P; isotypes, P, TAN). Figure 1.

Albiziae gummiferae affinis sed ab ea folii rhachidi canaliculata (vel subporcata), foliorum costis subter glabris vel sparse pubescentibus ac, nervillis reticulum apertum formantibus, florum basilarium calycibus cylindricis et corollis longioribus (*A. mainaea:* 8.25–10.00 mm, *A. gummifera:* 7–9 mm), ovario pubescente cum 9–10 ovulis, floris apicalis calyce doliiforme vel campanulato, juveni legumine pubescente (vetere legumine sub-glabro) differt.

Tree to 15 m tall; bole to 60 cm diam.; twigs densely yellow to rusty-yellow pubescent at first, glabrescent, blackish with rust-colored lenticels. Stipules densely pubescent, narrowly ± asymmetrically lanceolate, 2.5–4.0 mm long, the apex acute. Petiole shortly pubescent, 3.0–5.5 cm long, grooved above with a gland in the basal half; rhachis shortly pubescent, 2.5–15.3 cm long, grooved to subridged above with 1–4 glands near the distal pinnae; pinnae 3–9 pairs, the rhachilla ± thinly pubescent, 2.5–11.0 cm long, ridged above with 1–2 glands near the distal leaflet pairs; leaflets 4–14 pairs, sessile, glabrous on both surfaces but with a ciliate margin, oblong-rhombic to asymmetrically rhombic, 4–23 × 3.5–11.0 mm, the proximal margin ± auriculate at the base, the distal margin attenuate-cuneate, the apex rounded or obtuse, mucronulate, the midvein diagonal, glabrous on both surfaces (sometimes with a few trichomes beneath) and slightly raised on both surfaces, the lateral veins 3–5 pairs ascending, arcuate and raised on both surfaces, the veinlets forming an open network generally conspicuous beneath.

Inflorescence an axillary or terminal panicle of clustered heads; peduncle thinly yellowish-pubescent, 1.5–5.0 cm long; interfloral bracts pubescent, narrowly oblanceolate (sometimes linear), 1.2–2.5 mm long. Basal flowers hermaphrodite, sessile or with a pedicel to 0.4 mm long; calyx shortly pubescent, cylindrical, 3.2–4.0 mm long, the lobes ovate-triangular, 0.30–0.50 mm long, with an acute apex; corolla pubescent (7.30)8.25–10.00 mm long, the lobes ovate-triangular, 1.25–2.50 mm long, with an acute apex; stamens red, 21.5–41.5 mm long, the tube long exserted, 18–38 mm long, anther broadly oblongoid, ca. 0.25 mm long, sometimes with some very short trichomes; ovary with an inconspicuous stipe ca. 0.5 mm long, shortly appressed-pubescent, very narrowly ellipsoid, 2.5–3.0 mm long, with 9–10 ovules, the style 3.3–4.5 cm long with a funnel-shaped stigma. Central flower male, sessile; calyx doliiform to campanulate, shortly pubescent, 3.0–4.3 mm long, sometimes split, lobes very irregular with a ciliate margin; corolla pubescent, 8–11 mm long, lobes ovate-triangular, 1–3 mm long, with an acute apex; stamens 12–16 mm long, the tube 5–9 mm long, coriaceous, non-exserted, the filaments strongly reflexed, anther as above; ovary absent.

Pod dehiscent, shortly pubescent to subglabrous when old, chartaceous-pergamentaceous, elliptic-oblong, 8.0–15.2 × 2.0–2.5 cm, the base attenuate and shortly stipitate, margins slightly thickened, often pubescent, the apex rounded-obtuse sometimes ± subapiculate, venation raised, forming an open network. Seed black or brown-blackish, broadly oblong, 7–13 × 6–9 mm, with an oblong, almost central pleurogram.

The specific epithet derives from *maina,* which means tropical dry forest in the Malagash language.

Albizia mainaea can be included in the *A.*

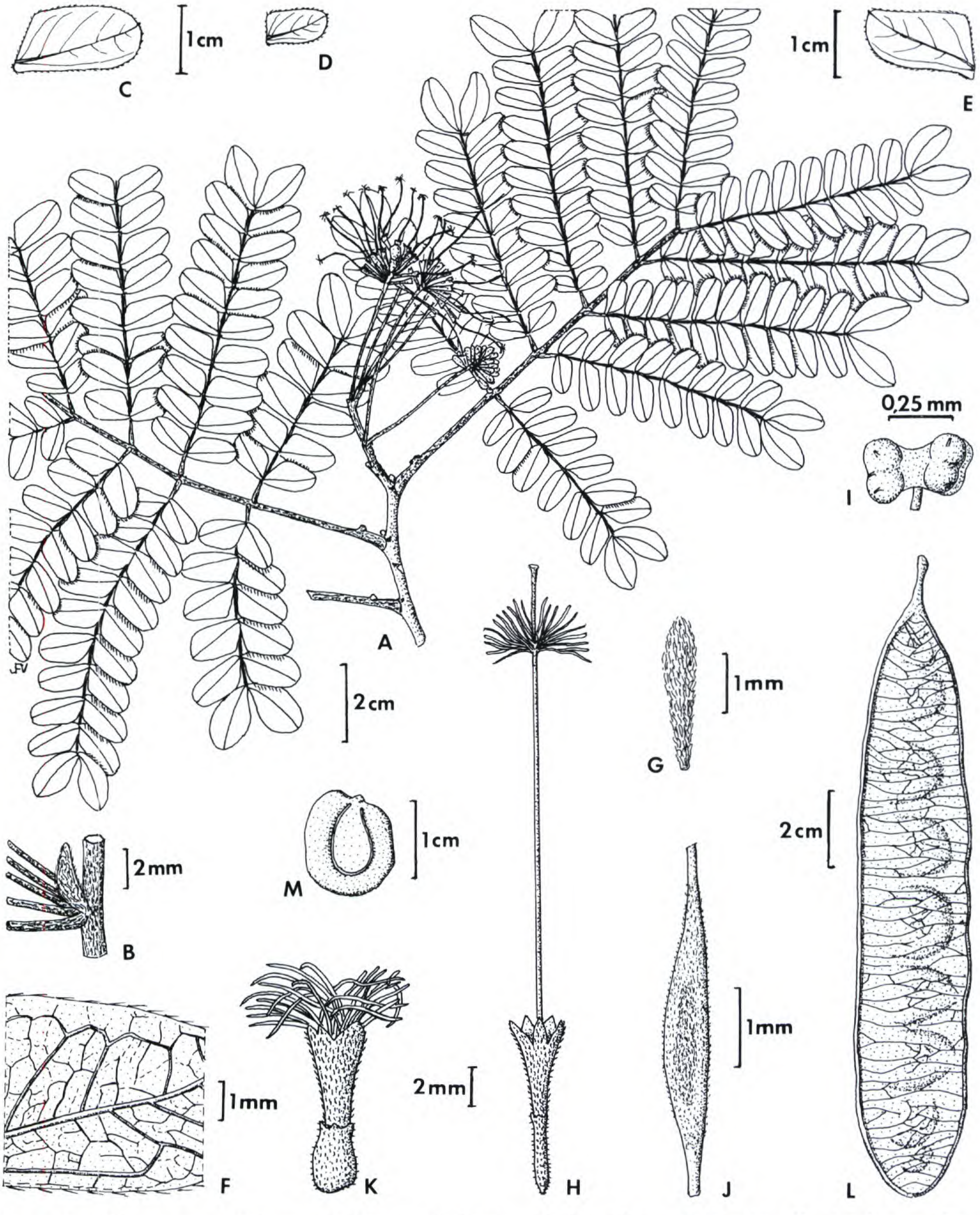

Figure 1. *Albizia mainaea* Villiers. —A. Habit. —B. Stipule. —C–E. Leaflets. —F. Venation of lamina, lower surface. —G. Interfloral bract. —H. Hermaphrodite flower. —I. Anther. —J. Ovary. —K. Central flower. —L. Pod. —M. Seed. (A, C, G–K based on *Perrier de la Bâthie 390*; B based on *Decary s.n.*; D based on *Service forestier Madagascar 12125 SF*; E, F, L, M based on *Seyrig 10d*).

gummifera complex sensu Brenan (1952). *Albizia gummifera* (J. F. Gmelin) C. A. Smith is a combination established by Smith (1930) for the botanical name of the "Flat-crown tree." The complex comprises: *A. adianthifolia* [*A. intermedia* De Wildeman & T. Durand, recognized by Brenan, is here considered as *A. adianthifolia* var. *intermedia* (De Wildeman & T. Durand) Villiers; see Villiers, 1989]; *A. gummifera* [*A. gummifera* var. *ealaensis* (De Wildeman) Brenan is a syn-

onym of *A. adianthifolia* var. *intermedia;* see Villiers, 1989]; and now *A. mainaea.*

Albizia mainaea is easily distinguished from *A. adianthifolia* by the lamina more or less auriculed at the proximal base and glabrous on both surfaces (the short raised pubescence of the upper surface, very characteristic of *A. adianthifolia,* is never seen in *A. mainaea*) and by the pubescent ovary. *Albizia mainaea* is most closely related to *A. gummifera,* differing in the grooved to subridged rhachis, the midrib of the leaflet glabrous on both surfaces, sometimes with a few trichomes beneath (vs. pubescent beneath in *A. gummifera*), the veinlets generally conspicuous beneath (vs. very lightly conspicuous in *A. gummifera*), the cylindrical calyx of basal flowers (vs. obconical in *A. gummifera*), the larger corolla (*A. mainaea*: 8.25–10.00 mm, *A. gummifera*: 7–8 mm), the longer stipe of the ovary, and the pubescent ovary with 9–10 ovules (vs. glabrous with 7 ovules in *A. gummifera*), the calyx doliiform to campanulate in the central flower (vs. cylindrical in *A. gummifera*), and the shortly pubescent young pod (vs. glabrous in *A. gummifera*).

Albizia mainaea, endemic to Madagascar, is present in all parts of the western region (perhaps except in the driest zones of the southern domain), in the Sambirano domain along the rivers, and in the western and southern part of the central domain up to 1000 m when the forest is disturbed. (Fig. 2).

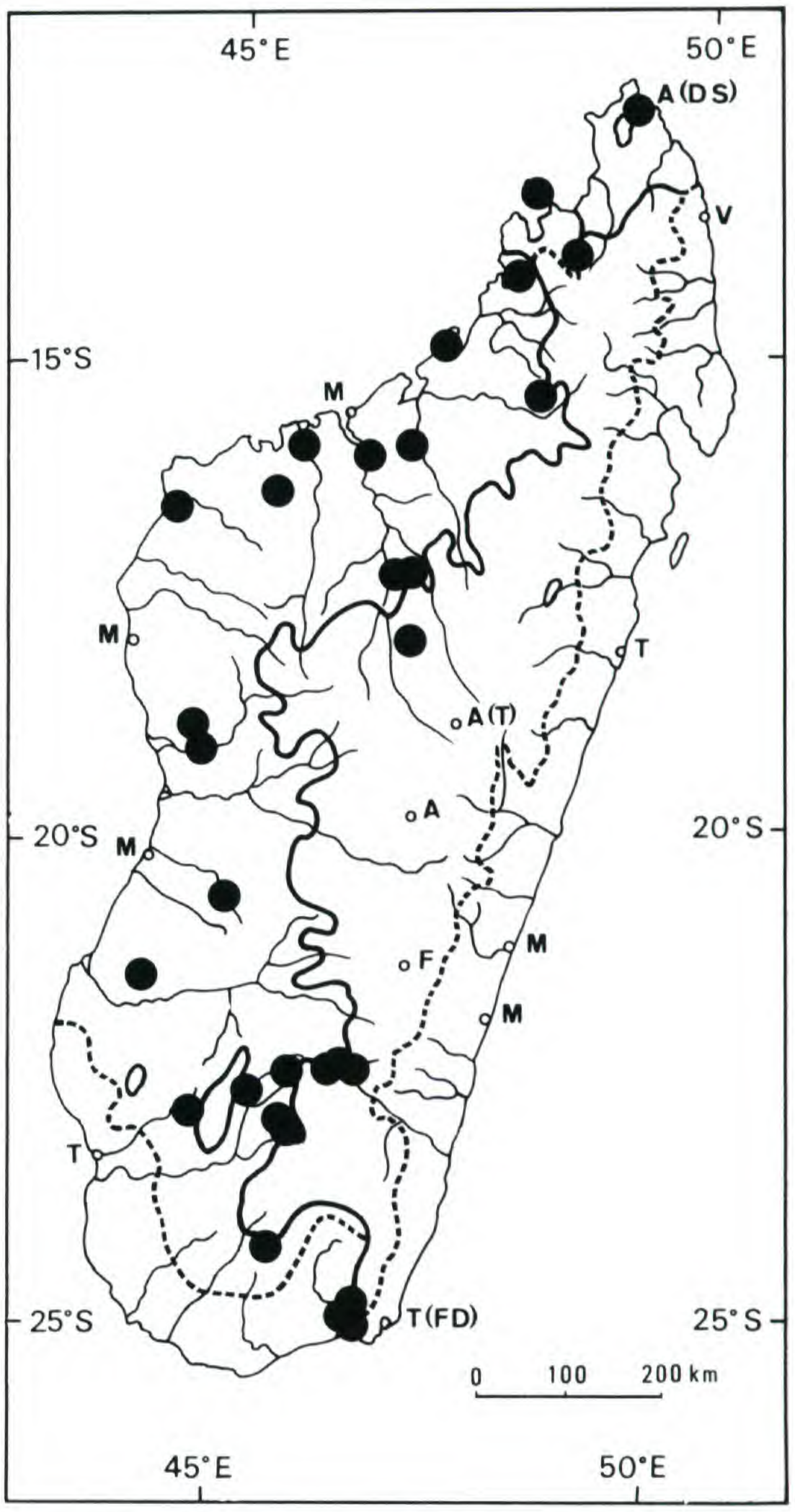

Figure 2. Known distribution of *Albizia mainaea.*

Paratypes. Madagascar. **Prov. Antananarivo**: Ambohitrandriana, distr. Ankazobe, *Service forestier Madagascar 16006 SF* (P). **Prov. Antsiranana**: Beangona, *Harizo 1274 RN* (P); Nossi Bé, Lokobé, *Hildebrandt 3123* (P); Sakaramy, Antsiranana, *Service forestier Madagascar 15049 SF* (P). **Prov. Fianarantsoa**: region of Ambararata, *Decary s.n.* (P); Isalo massif, SW Ranohira, 22°37′17″S, 45°21′40″E, *Du Puy, Labat & Comtet M682* (K, MO, P); Horombe plateau, W valley of Ihosy, *Humbert 2941* (P); Zazafotsy forest, near Ihosy, *Keraudren 322* (P); rests of forest in the valley of river Menaraha, between Ihosy and Ivohibe, alt. 600–800 m, *Léandri & Ratoto in Léandri 3449* (P). **Prov. Mahajanga**: Besalampy, *Adanimarobaina 68* (= *5987 SF*) (P); Ankarafantsika, *Bosser 8444* (MO, P); Maromandia (Ambalika), *Decary 1072* (P); gorges of Manombolo, *Léandri 429* (P); Beritsoka, *Perrier de la Bâthie 390* (P); Mandraty, left bank of Ikopa, between Maevatanana and Andrika, *Perrier de la Bâthie 12132* (P); Madirovalo (Boiny), *Perrier de la Bâthie 13882* (P); Tsaramandroso, distr. Ambato-Boeni, *Ramanonjisoa 2534 RN* (P); Andranomavo, distr. Soalala, *Randriamiera 7735 RN* (P); Mitsinjo, road to Namakia, *Service forestier Madagascar 4302 SF* (P); Ambalatsingy, distr. Analalava, *Service forestier Madagascar 11123 SF* (P); between Mevahakia and Tsarahonenana, near Mavahakia, canton Tsarahonenana, distr. Befandriana Ava., *Service forestier Madagascar 19801 SF* (P); 22 km SSE Antsalova, 9 km E Ankiliromotsy, *Villiers, Klackenberg & Badré 4985* (P); Beala forest, Manja, *s.c. 28.R.279* (P). **Prov. Toliara**: Vinambe, distr. Tolianaro, *Decary 10851* (P); NW Tolanaro, Integral Reserve 11 (Andohahela), 24°45′S, 46°51′E, *Malcomber, van der Werff, Gray, Raparanivo & Randriamampionana 1657* (MO, P); Lambonakandro (Isalo), *Perrier de la Bâthie 18596* (*leg Drouhard*) (P); Nat. Réserve 11, Behara, *Rakotoniama 6218 RN* (P); Bevahy, Morondava, *Service forestier Madagascar 4080 SF* (P); Aborontsy, Andriandampy, Betroka, *Service forestier Madagascar 6340 SF* (P); Manampaza river, Ranopiso, *Service forestier Madagascar 11167 SF* (P); Sakata, Betroka, *Service forestier Madagascar 12125 SF* (P); Ampandradava, between Bekily and Tsivory, *Seyrig 10d* (P).

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New Taxa, New Combinations, and Notes on Chinese Gesneriaceae

Anna L. Weitzman, Laurence E. Skog
Department of Botany, MRC-166, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560-0001, U.S.A.

WANG Wen-tsai, PAN Kai-yu, and *LI Zhen-yu*
Laboratory of Systematic and Evolutionary Botany, Institute of Botany, Chinese Academy of Sciences, Xiangshan, Beijing 100093, China

ABSTRACT. Preparation of the Gesneriaceae for the *Flora of China* has revealed new taxa, including one new genus, *Paraisometrum*; thirteen new species, *Chirita atroglandulosa, C. napoensis, C. pungentisepala, C. pycnantha, C. shouchengensis, C. shuii, C. skogiana, C. wangiana, Didymocarpus subpalmatinervis, Hemiboea wangiana, Opithandra burttii, Oreocharis dentata, Paraisometrum mileense*; and seven new combinations, *Chirita demissa, Hemiboea subcapitata* var. *guangdongensis, Lysionotus microphyllus* var. *omeiensis, Lysionotus pauciflorus* var. *ikedae, Oreocharis aurea* var. *cordato-ovata, Paraboea glutinosa,* and *Tengia scopulorum* var. *potiflora.* The new taxa are described, discussed, and compared with related taxa. The transfer and status changes are justified.

As a preface to the treatment of Gesneriaceae for the *Flora of China,* it seems worthwhile to make a brief introduction to the terminology used in the treatment. First, the use of "one vs. two stigmas": Each carpel of the bicarpellate ovary in flowers of Gesneriaceae may produce a stigma. These two stigmas are more or less fused into a single structure from the base, but are, to some degree, free at the apex in some genera, e.g., *Chirita* Buchanan-Hamilton, and often further bilobed. Non-Chinese specialists on Gesneriaceae have traditionally considered the stigma to be a single structure and to be either simple (capitate) or bilobed, whereas Chinese botanists consider each of the two stigmas as units following the early study of stigmas in *Chirita* by Robert Brown (1839). The distinction can be blurred, however, because the two stigmas may be completely fused into one with a capitate apex (then sometimes referred to as terminal, as in *Didymocarpus* Wallich) or the upper of the two carpels or stigmas may be aborted resulting in a single stigma which is often bilobed (see also Burtt, 1992). In the treatment of Gesneriaceae for the *Flora of China,* Chinese usage is maintained, but a family-wide investigation of stigma development and fusion is needed for clarification.

In delimiting genera of Gesneriaceae for the upcoming treatment, emphasis is placed on ease of use rather than phylogeny. In other words, genera are recognized and delimited, in part, for convenience in key-making in the judgment of Wang Wen-tsai, the senior author of the treatment for the *Flora of China.* Nevertheless generic limits are sometimes very difficult to discern. For example, *Didymocarpus* and *Chirita* overlap in nearly all characters, and the only character that consistently distinguishes them is stigma position (abaxial in *Chirita* and terminal in *Didymocarpus*), which can be difficult to see on dried specimens. Similarly, *Oreocharis* Bentham, *Ancylostemon* Craib, *Tremacron* Craib, and *Isometrum* Craib can only be distinguished in flowering condition. Further, even those characters used to distinguish them are intermediate in some species. The result of using these characters alone is that groups of taxa that are most similar vegetatively are spread across all four genera. Similarly, *Briggsia* Craib and *Loxostigma* C. B. Clarke are placed in radically different parts of the family in the *Flora of China* based on a single character, seed appendage. However, there are species in the two genera that are nearly indistinguishable in vegetative and floral characters.

Generic limits and phylogenetic relationships in Asian Gesneriaceae are not well understood, and that lack of knowledge is reflected in the *Flora of China* treatment.

Chirita atroglandulosa W. T. Wang, sp. nov. (*Chirita* sect. *Gibbosaccus* C. B. Clarke). TYPE: China. Guangxi: Longzhou, on cliffs, *H. B. Morse 471* (holotype, NY).

Herba perennis. Rhizoma obconicum, 0.9–1.2 cm longum, ca. 1 cm crassum. Folia omnia basalia ca. 12; laminae chartaceae, anguste ellipticae vel anguste ovatae, 2–7.5 cm longae, 0.8–2.8 cm latae, apice acutae, basi cu-

neatae, margine subintegrae vel repandae, utrinque dense adpresseque puberulae, supra pilis 0.8–1.1 mm longis et 0.15–0.5 mm longis tectae, nervis lateralibus utrinsecus 3 inconspicuis; petioli complanati, 0.2–1.4 cm longi, 2–4 mm lati, utrinque adpresse puberuli. Cymae ca. 2, axillares, bis ramosae, ca. 5-florae; pedunculi 12–13 cm longi, patule puberuli; bracteae oppositae, ovatae vel anguste ovatae, 6.5–7 mm longae, 2.5–3 mm latae, utrinque dense adpresseque puberulae; pedicelli 0.3–1.8 cm longi, dense puberuli et glanduloso-puberuli. Calyx prope basin 5-sectus, segmentis anguste triangular-lanceolatis, 4–5 mm longis, 1–1.1 mm latis, utrinque adpresse puberulis. Corolla ca. 3 cm longa, extus sparse puberula, intus prope basin labii superi et infra filamenta puberula; tubo infundibuliformi-tubulari, ca. 2 cm longo, ore 1 cm diam.; labio supero ca. 4 mm longo, 2-lobato, lobis late ovatis, labio infero ca. 10 mm longo, prope medium 3-fido, lobis orbiculari-ovatis. Stamina cum staminodiis 10 mm supra basin corollae adnata; filamentis lineari-subulatis, ca. 9 mm longis, prope medium geniculatis, basi et supra medium atro-glanduloso-puberulis; antheris reniformi-oblongis, ca. 3 mm longis, glabris; staminodia 2, lineari-subulata, ca. 3 mm longa, apice saepe capitata, glabra. Discus annularis, ca. 0.4 mm altus. Pistillum ca. 15 mm longum; ovario lineari, ca. 9 mm longo, 1 mm lato, dense adpresseque puberulo; stylo ca. 3 mm longo, glabro; stigmate anguste oblongo, ca. 2 mm longo, apice emarginato.

Herbs perennial, stemless. Rhizome 0.9–1.2 × ca. 1 cm. Leaves basal, ca. 12; petiole flattened, 0.2–1.4 × 0.2–0.4 cm, appressed puberulous on both sides; lamina chartaceous, narrowly elliptic to narrowly ovate, 2–7.5 × 0.8–2.8 cm, both surfaces densely appressed puberulous, adaxial hairs 0.8–1.1 and 0.15–0.5 mm; base cuneate, margin subentire to repand, apex acute; lateral veins ca. 3 pairs, inconspicuous. Cymes 2–3, axillary, 2 × branched, ca. 5-flowered; peduncle 12–13 cm, spreading puberulous; bracts 2, free, opposite, ovate to narrowly ovate, 6.5–7 × 2.5–3 mm, both surfaces densely appressed puberulous; pedicel 0.3–1.8 cm, densely puberulous and glandular puberulous. Calyx 5-sect to near base, segments narrowly triangular-lanceolate, 4–5 × 1–1.1 mm, both surfaces appressed puberulous, margin entire, apex acute. Corolla ca. 3 cm, outside sparsely puberulous, inside puberulous near base of upper lip and below filaments; tube funnelform-tubular, ca. 2 cm, mouth ca. 1 cm diam.; upper lip ca. 4 mm, 2-lobed, lobes broadly ovate; lower lip ca. 10 mm, 3-lobed to near middle, lobes orbicular-ovate. Stamens and staminodes adnate to ca. 10 mm above corolla tube base; filaments linear-subulate, ca. 9 mm, geniculate near middle, black glandular-puberulous above middle; anthers fused by entire adaxial surfaces, reniform-oblong, ca. 3 mm, glabrous; staminodes 2, linear-subulate, ca. 3 mm, apex often capitate, glabrous. Disc annular, ca. 0.4 mm. Pistil ca. 15 mm; ovary linear, ca. 9 × 1 mm, densely appressed puberulous; style ca. 3 mm, glabrous; stigma narrowly oblong, ca. 2 mm, apex emarginate.

This species is related to *Chirita eburnea*, from which it differs in smaller leaf blades, bracts, and calyces, stamen filaments with black glandular hairs, glabrous staminodes, and an emarginate stigma. In *C. eburnea*, the leaf blade is up to 17 cm long, bracts are 1–4.5 cm long, the calyx is 0.9–1 cm long, filaments are merely glandular puberulous, the staminode is pilose, and the stigma is 2-lobed. Other specimens seen collected by Morse with the same number are *Chirita eburnea*.

Chirita demissa (Hance) W. T. Wang, comb. nov. Basionym: *Didymocarpus demissus* Hance, as "*demissa*," J. Bot. 21: 166. 1883. TYPE: China. Guangdong: on rocks near Sai-gnau on the Lien-chau river, 210 m, 5 Oct. 1881, *B. C. Henry in Herb. Hance 22142* (holotype, BM; isotype, K not seen).

This species is transferred from *Didymocarpus* to *Chirita*, because the stigma is abaxial and oblong. This may be due to abortion of the adaxial stigma. In *Didymocarpus*, the stigma is terminal and capitate or discoid in shape, probably formed by fusion of the adaxial and abaxial stigmas.

Chirita napoensis Z. Y. Li, sp. nov. (*Chirita* sect. *Gibbosaccus*). TYPE: China. Guangxi: Napo, Longhua, ad scopulos in vallis, 600 m, 12 May 1989, *Exped. Hongshuihe. Inst. Bot. Austrosin. Acad. Sin. 689* (holotype, PE; isotype, IBSC).

Herba perennis. Rhizoma ca. 0.5 mm longum, ca. 0.6 mm crassum. Folia 4–10, omnia basalia, petiolata; laminae in sicco papyraceae, late ellipticae vel oblongae, 2.5–4.2 cm longae, 1–3 cm latae, apice obtusiusculae, basi oblique cuneatae, decursivae, margine crenatae vel repando-crenatae, utrinque pilis albis adpressis dense tectae, nervis lateralibus utrinsecus 3–4 inconspicuis; petioli 1–1.7 cm longi, complanati, dense puberuli. Scapi 2–7, ascendentes, 2.5–6.5 cm alti, cum pedicellis dense puberulis; cymae 1–2-florae; bractae oppositae, anguste oblongae, 1.5–3.5 mm longae. Calyx ad basin 5-sectus, segmentis viridibus, lanceolato-linearibus, 2.5–3 mm longis, 0.7–0.9 mm latis, extus puberulis, intus pilosellis. Corolla subcampanulata, coeruleo-lilacina, ca. 1.4 cm longa, extus puberula et glanduloso-puberula, intus glabra; tubo subtubulari, ca. 8.5 mm longo, ore ca. 4 mm diam.; labio postico ca. 2 mm longo, ad basin 2-secto, lobis semiorbicularibus, labio antico ca. 5.5 mm longo, prope medium 3-lobato, lobis suborbicularibus. Stamina 2, filamentis ad ca. 7 mm supra corollae basin insertis, subulato-linearibus, ca. 4 mm longis, inferne ca. 1 mm superne ca. 0.4 mm latis, supra basin geniculatis, glabris; antheris ca. 3 mm longis, glabris; staminodia 2, ad ca. 6.5 mm supra corollae basin inserta, anguste linearia, ca. 0.7 mm longa, glabra. Discus nullus. Pistillum ca. 13 mm

longum, ovario lineari, ca. 3 mm longo 0.4 mm lato, stigmate anguste oblongo 1.2 mm longo indiviso. Capsulae juvenales lineares, ca. 1.5 cm longae, 1.2 mm crassae, dense puberulae.

Herb, perennial, stemless. Rhizome ca. 0.5 mm, ca. 0.6 mm diam. Leaves 4–10, basal; petiole 1–1.7 cm, flattened, densely puberulous; leaf blade broadly elliptic to oblong, 2.5–4.2 × 1–3 cm, papery when dry, both surfaces densely appressed white pilose; base oblique, cuneate, decurrent; margins crenate to repand crenate; apex minutely obtuse; lateral veins 3–4 pairs, inconspicuous. Cymes 2–7, ascending, 2.5–6.5 cm, 1–2-flowered; bracts 2, opposite, narrowly oblong, 1.5–3.5 mm. Calyx 5-sect, segments green, lanceolate-linear, 2.5–3 × 0.7–0.9 mm, outer surface puberulous, inner pilose. Corolla blue-violet, subcampanulate, ca. 1.4 cm, outer surface puberulous and glandular puberulous, inner glabrous; tube subtubular, ca. 8.5 mm, mouth ca. 4 mm diam.; upper lip 2-sect, ca. 2 mm, lobes semiorbicular; lower lip 3-lobed to near middle, ca. 5.5 mm, lobes suborbicular. Stamens 2, adnate to corolla tube for ca. 7 mm, filaments subulate-linear, ca. 4 × 1 (near base) and 0.4 (above) mm, geniculate above base, glabrous; anthers ca. 3 mm, glabrous. Staminodes 2, adnate to corolla tube for ca. 6.5 mm, linear, ca. 0.7 mm, glabrous. Disc absent. Pistil ca. 1.3 cm, densely puberulous; ovary linear, ca. 3 × 0.4 mm; stigma narrowly oblong, ca. 1.2 mm, entire. Immature capsule linear, ca. 15 × 1.2 mm, densely puberulous.

Distribution and ecology. Plants of this species are found only in the province of Guangxi, in Napo, at Longhua, on a cliff in a valley, at 600 m elevation, apparently flowering in May.

Chirita pungentisepala W. T. Wang, sp. nov. (*Chirita* sect. *Gibbosaccus*). TYPE: China. Guangxi: Longzhou, *H. B. Morse 196* (holotype, K).

Herba perennis. Rhizoma subteres, ca. 6 mm crassum. Folia omnia basalia, ca. 9; laminae chartaceae, anguste ellipticae, 3.5–8.5 cm longae, 1–2.5 cm latae, apice acutae, basi attenuatae, margine integrae, supra pilis 1–1.8 mm longis et 0.3–0.5 mm longis dense tectae, subtus dense puberulae, nervis lateralibus utrinsecus ca. 5, inconspicuis; petioli complanati, 0.8–2.8 cm longi, 3–5 mm lati, dense adpresseque pubescenti. Cymae ca. 2, axillares, semel vel bis ramosae, 2–4-florae; pedunculi 5–7.8 cm longi, patule puberuli et glanduloso-puberuli; bracteae oppositae, triangulari-lineares, 5–13 mm longae, ca. 1.6 mm latae, pubescentes; pedicelli 2.7–5 cm longi, glanduloso-puberulosi et pilosi. Calyx ad basin 5-sectus, segmentis anguste triangulari-linearibus, ca. 6 mm longis, 1.2 mm latis, apice subulati-acuminatis, extus pubescentibus, intus glabris. Corolla ca. 3.5 cm longa, extus sparse adpresseque puberula, intus infra filamenta pilosa; tubo infundibuliformi-tubulari, ca. 2.5 cm longo, ore 1 cm diam.; labio supero ca. 5 mm, 2-lobato, lobis late ovatis, labio infero ca. 10 mm longo, 3-lobato, lobis orbiculari-ovatis. Stamina cum staminodiis ca. 10 cm supra basin corollae adnata, glabra; filamentis lanceolato-linearibus, 13 mm longis, supra medium arcuato-curvatis; antheris oblongis, ca. 3 mm longis; staminodia 2, anguste lancolato-linearibus, 7–8 mm longis, glabris, apice saepe capitatis. Discus annularis, ca. 0.6 mm altus. Pistillum ca. 2.2 cm longum; ovario lineari, ca. 14 mm longo, 1.6 mm lato, dense glanduloso-puberulo; stylo sparse glanduloso-puberulo; stigmate suboblongo ca. 1.5 mm longo, apice 2-lobulato.

Herbs, perennial, stemless. Rhizome subterete, ca. 6 mm diam. Leaves basal, ca. 9; petiole flattened, 0.8–2.8 × 0.3–0.5 cm, densely appressed pubescent; leaf blade narrowly elliptic, 3.5–8.5 × 1–2.5 cm, papery; upper surface densely appressed pilose, hairs 1–1.8 and 0.3–0.5 mm, lower surface densely puberulous; base attenuate, margin entire, apex acute; lateral veins ca. 5 pairs, inconspicuous. Cymes ca. 2, axillary, 1 or 2 × branched, 2–4-flowered; peduncle 5–7.8 cm, spreading puberulous and glandular puberulous; bracts 2, opposite, triangular-linear, 5–13 × ca. 1.5 mm, pubescent; pedicel 2.7–5 cm, glandular puberulous and pilose. Calyx 5-sect to base, segments narrowly triangular-linear, ca. 6 × 1.2 mm, outer surface pubescent, inner surface glabrous, margin entire, apex subulate acuminate. Corolla ca. 3.5 cm, outer surface sparsely appressed puberulous, inner surface pilose below filaments; tube funnelform-tubular, ca. 2.5 cm, mouth ca. 1 cm diam.; upper lip ca. 5 mm, 2-lobed, lobes broadly ovate; lower lip ca. 10 mm, 3-lobed, lobes orbicular-ovate. Stamens and staminodes adnate to ca. 10 mm above base of corolla tube; stamens glabrous, filaments lanceolate-linear, ca. 13 mm, arcuate above middle; anthers fused by entire adaxial surfaces, oblong, ca. 3 mm; staminodes 2, narrowly lanceolate-linear, 7–8 mm, glabrous, apex often capitate. Disc annular, ca. 0.6 mm. Pistil ca. 2.2 cm, ovary linear, ca. 14 × 1.6 mm, densely glandular puberulous; style sparsely glandular puberulous; stigma suboblong, ca. 1.5 mm, apex 2-lobed. Fruits and seeds unknown.

This species may be related to *Chirita bicolor*, from which it is distinguished by its abaxially puberulous leaf blade, longer pedicel, subulate-acuminate calyx segments, and glabrous anthers. In *C. bicolor*, the leaf blade is velutinous abaxially, the pedicel is shorter, 6–12 mm, the calyx segment apex is obtuse, and the anthers are dorsally brown barbate. Other specimens seen collected by Morse with the same number are *Chirita linearifolia* W. T. Wang.

Chirita pycnantha W. T. Wang, sp. nov. (*Chirita* sect. *Chirita*). TYPE: China. Yunnan: Simao, *A. Henry 13575* (holotype, NY; isotype, K).

Herba perennis (?). Caules 2.2–9 cm alti, 1–1.5 mm crassi, glabri, simplices, 1-foliati. Folia basalia nulla. Folium caulinum longe petiolatum; lamina papyracea, leviter inaequilateralis, ovata, 4–9 cm longa, 2.1–5.4 cm lata, apice acuta, basi subtruncata vel uno latere rotundato-truncata altero latere cuneata, margine crenata, ciliolata, supra sparse puberula, subtus ad nervos sparse puberula, nervis lateralibus utrinsecus 7–8; petioli 1.8–9 cm longi, sparsissime puberuli. Cyma fere terminalia, saepe subglobosa, 1.5–2.8 cm diam., dense 2–6 flora; pedunculus 0.5–6 cm longus, glaber; bracteae depresse semiorbiculares, 5–7 mm longae, 10–20 mm latae, glabrae; pedicelli robusti, ca. 1.8 mm longi. Calyx ca. 1.3 cm longus, 5-lobatus, glaber, lobis deltoideis ca. 4 mm longis, 4.8 mm latis. Corolla ca. 3.2 cm longa, glabra; tubo infundibuliformi, ca. 3 cm longo, ore 1.8 cm diam.; labio supero ca. 2 mm longo, 2-lobato, labio infero ca. 4 mm longo, 3-lobato, lobis depresse semiorbicularibus. Stamina cum staminodiis ca. 14 mm supra basin corollae adnata; filamentis lineari-subulatis, ca. 9 mm longis, prope medium geniculatis, minute glandulosis; antheris oblongis, 3 mm longis, glabris; staminodia 2, linearia, 4–5.5 mm longa, glabra, apice paulo dilatata. Discus annularis, ca. 0.8 mm altus. Pistillum ca. 2.9 cm longum, sparse minute adpresseque puberulum; ovario lineari, ca. 1.7 cm longo, 1.5 mm lato; stylo 9 mm longo; stigmate ambitu flabellato, ca. 3 mm longo, 5 mm lato, fere ad basin 2-partito, lobis anguste oblongis.

Herbs, probably perennial. Stem simple, 2.2–9 cm × 1–1.5 mm, glabrous. Leaves 1–3, cauline; petiole 1.8–9 × 0.1–0.2 cm, sparsely puberulous; leaf blade slightly oblique, ovate, 4–9 × 2.1–5.4 cm, papery, adaxially sparsely puberulous, abaxially sparsely puberulous on veins; base cuneate to truncate-rounded, margin crenate, ciliolate, apex acute; lateral veins 7–8 pairs, conspicuous. Cymes 1 or 2, subglobose, 1.5–2.8 cm diam., densely 2–6-flowered; peduncle 0.5–6 cm, glabrous; bracts depressed semiorbicular, 5–7 × 10–20 mm, glabrous, margin subentire, apex truncate-rounded. Pedicel robust, ca. 1.8 mm, glabrous. Calyx ca. 1.3 cm, tube ca. 0.9 cm, 5-lobed to above middle, lobes equal, deltoid, ca. 4 × 4.8 mm, both surfaces glabrous, margin entire, apex acute. Corolla ca. 3.2 cm, both sides glabrous, tube infundibuliform, ca. 3 cm, mouth ca. 1.8 cm diam., upper lip ca. 2 mm, 2-lobed, lower lip ca. 4 mm, 3-lobed, all lobes depressed-semiorbicular. Stamens and staminodes adnate to corolla tube for ca. 14 mm above base, filaments linear-subulate, ca. 9 mm, geniculate near middle, minutely glandular; anthers fused by entire adaxial surfaces, oblong 3 mm, glabrous; staminodes 2, 4–5.5 mm. Disc annular, 0.8 mm. Pistil ca. 2.9 cm, sparsely minutely appressed puberulous; ovary linear, ca. 1.7 cm × 1.5 mm; style ca. 9 mm; stigma flabellate, ca. 3 × 5 mm, 2-parted nearly to base, lobes narrowly oblong.

This species is remarkable in its short, simple stem with a single leaf at its apex, in the depressed semiorbicular involucre-like bracts, which closely surround the dense inflorescence of short-pedicelled flowers, in the short corolla limb, and in the stigma being large, and deeply 2-lobed (nearly to the base). On the basis of these diagnostic characters, this species can be distinguished from related species in *Chirita* sect. *Chirita*.

Chirita shouchengensis Z. Y. Li, sp. nov. (*Chirita* sect. *Gibbosaccus*). TYPE: China. Guangxi: Liuzhou, cultivated in Longtan Park, alt. 150 m, introduced from Shoucheng (25°11′N, 109°7′E), Youngfu County, cliff in the limestone hills, 250 m, 10 May 1993, *Xiong Shi 93-1* (holotype, PE).

A *C. bicolori* W. T. Wang in foliis 2–3 cm longis 0.5–1 cm latis, nervis lateralibus utrinsecus 2–3; cymis 1-floris, pedunculis 9–11 mm longis; calycis segmentis 10–12 mm longis, 1.6–1.8 mm latis; disco glabris differt.

Herbs perennial, stemless. Rhizome obconic, to 12 × 8 mm. Leaves more than 10, crowded at apex of rhizome, opposite, petiolate; blades oblanceolate, 2–3 × 0.5–1 cm, papery when dry, adaxial surface green, white puberulous, abaxial surface appressed white velutinous, base decurrent, margin entire, apex acute; lateral veins of 2 or 3 pairs, inconspicuous; petioles ca. 10 × 1–2 mm, velutinous. Inflorescence of 3–many cymes from the axils of the crowded leaves, each with 1 erect flower; peduncles 9–11 mm, densely puberulous; bracts 2, oblong-linear, 4–6 × ca. 1 mm, both surfaces densely puberulous; pedicels 7–11 mm, densely puberulous; calyx 5-lobed to base, each segment lanceolate-linear, 10–12 × 1.6–1.8 mm, outside puberulent, inside glabrous, margin entire, puberulent and puberulous, apex acuminate; corolla lilac purple, ca. 4.5 cm, outside sparsely puberulous, inside glabrous, tube ca. 3.3 cm, ca. 1.4 cm diam. at mouth, upper lip ca. 8 mm, 2-lobed, lower lip ca. 12 mm, 3-lobed, each orbicular; stamens 2, filaments lanceolate-linear, adnate for ca. 14 mm to corolla base, ca. 11 mm, ca. 1.2 mm wide basally, ca. 0.8 mm wide apically, geniculate above base, glabrous, anthers elliptic, ca. 4 mm, lanate; staminodes 2, linear, 3–4 mm, glabrous; disc annular, ca. 0.5 mm, glabrous; pistil ca. 3.4 cm, densely puberulous, ovary linear, ca. 12 × 1.9 mm, lower lobe of stigma linear to oblong, ca. 3.5 mm long, upper lobe 2-parted, each lobe linear-lanceolate, ca. 1 mm. Fruit unknown.

Distribution and ecology. Native to Guangxi at Shoucheng in Youngfu County, growing at 250 m, on a cliff in the limestone hills. Flowering is known from April to June.

One of the flowers on the holotype specimen appears to be abnormal, having only a single fertile stamen, associated with the two-lobed lower lip of the corolla, as well as the two unequal lobes of the lower stigma. One stigma lobe is triangular, 0.3 mm long, the other lobe is linear to oblong, and 1 mm long. A similar abnormal flower with a single fertile stamen was found in *Dayaoshania cotinifolia* W. T. Wang (Wang, 1983a).

Chirita shuii Z. Y. Li, sp. nov. (*Chirita* sect. *Chirita*). TYPE: China. Yunnan: Wenshan, S slope of Baozhushan, 2600 m, 27 July 1993, *Shui Yu-min 00312* (holotype, PE).

A *C. urticifolia* Buchanan-Hamilton ex D. Don in caule et pedunculis glabris, calyce albi, corolla 5.9–6.1 cm longa, flavida differt.

Herbs perennial, caulescent. Rhizome 3–4 × 0.4–0.9 cm. Stem erect, 18–34 cm, to 7 mm diam., glabrous or subglabrous, unbranched or rarely branched with 3 or 4 nodes. Leaves opposite, 2 to 4 pairs at stem or branch apices; petiole 1.2–9.5 cm, glabrous or abaxially pilose; blade elliptic, broadly ovate or suborbicular, 2.5–21.4 × 2.5–11.2 cm, herbaceous when dry, apex acute or rounded, base unequal, one side cuneate, broadly cuneate to rounded, or auriculate, the other side narrowly cuneate to cuneate, rarely rounded, margin dentate or repand-crenate, adaxially appressed white puberulous, abaxially glabrous or puberulous around the veins; lateral veins 4–9 pairs. Inflorescences of axillary and pseudo-terminal cymes, each 1- or 2-flowered; peduncles 1–6 cm, glabrous; bracts opposite, ovate or lanceolate, 0.5–1.7 × 2–8 mm, ciliate; pedicels 3–5(–8.5) cm; calyx white, campanulate-tubular, 2.4–3 cm, pilose outside, inside glabrous, tube 1.3–1.9 cm, 5-lobed to the middle, posterior lobes 11–12 × 4–6 mm, anterior lobes ca. 8 × 2–5 mm, lobes ovate to lanceolate, apices cuspidate; corolla pale yellow with pale brown lines in throat, 5.9–6.1 cm, outside sparsely puberulous, inside glabrous; tube 4.2–4.5 cm, ca. 1.1 cm diam. at mouth; upper lip ca. 1.1 cm, lower lip ca. 1.6–1.7 cm; filaments lanceolate-linear, adnate for ca. 20 mm to corolla base, ca. 8 mm, geniculate at the middle, curved above, to 1.5 mm wide, glabrous, anthers ca. 4.5 mm, glabrous; staminodes 2, ca. 2.5 mm, glabrous; disc annular, ca. 1.8 mm, glabrous; pistil ca. 3.8 cm; ovary linear, dorsiventrally compressed, ca. 24 × 1.5 mm, glabrous, lower lip of stigma ca. 4 mm, 2-parted, lobes oblong. Capsules 14–18.5 × 0.25 cm, glabrous. Seeds brown, fusiform, ca. 0.6 mm, glabrous.

Distribution and ecology. Plants known only from the province of Yunnan at Wenshan, growing on the south slope of Baozhushan, a mountain overgrown with *Leptocanna chinensis* (Rendle) L. C. Chia & H. L. Fung (a rock-dwelling bamboo), on rocky cliffs or beside mountain streams under dense forest in gullies, at 2600–2850 m. Flowering specimens have been collected in July to September, and fruiting specimens from September to October. The species is named in honor of the collector of the type specimen.

Paratype. CHINA. **Yunnan:** Wenshan, S slope of Baozhushan, 2850 m, fruiting, 6 Oct. 1992, *Shui Yu-min 00527* (PE).

Chirita skogiana Z. Y. Li, sp. nov. (*Chirita* sect. *Gibbosaccus*). TYPE: China. Gansu: Wenxian, Bikou (32°9′N, 105°1′E), ad scopulos in vallis, 900 m, 18 Apr. 1992, *Qin Hai-ning 270* (holotype, PE).

Herba perennis. Rhizoma ca. 1.5 cm longum, apice ca. 6 mm crassum. Folia ca. 4, basalia, petiolata; laminae herbaceae, valde inaequilaterales ovatae vel ovato-ellipticae, 3–9 cm longae, 2–3.3 cm latae, apice acutiusculae, basi latere cuneateae altero latere rotundatae, margine repando-denticulatae, utrinque adpresse pilosellae (pilis 1–1.2 mm longis) et puberulae (pilis 0.2–0.5 mm longis), nervis lateralibus utrinsecus 3–4; petioli 2.5–3 cm longi, complanati, piloselli. Scapi 1–2, 6–8 cm alti; cymae semel ramosae, 1–2-florae; bracteae oppositae, oblong-lanceolatae, 8–9 mm longae, 2 mm latae, apice acutiusculae, margin pauce denticulatae, utrinque adpresse puberulae; pedicelli 0.7–1 cm longi, piloselli. Calyx ad basin 5-sectus, segmentis elliptico-lanceolatis, paulo inaequalibus, 7–7.5 mm longis, 1.8–2.1 mm latis, apice acutis vel obtusis, supra basin 4–6-denticulatis, extus brunneis pilosellis, intus viridibus glabris. Corolla carnea, ca. 2.3 cm longa, extus glanduloso-puberula, intus ad basin pilosella; tubo subtubulari, ca. 12 mm longo, ore ca. 6 mm diam.; labio postico ca. 3 mm longo, 2-fido, labio antico 11 mm longo, 3-fido, lobis semiorbicularibus. Stamina 2, filamentis ca. 8 mm supra corollae basin insertis, ca. 8 mm longis, glabris, prope medium geniculatis; antheris ca. 3.5 mm longis, glabris; staminodia 2, supra corollae basin inserta, 6 mm longa, anguste linearia, ca. 1.5 mm longa, glabra, apice capitata. Discus annularis, ca. 0.5 mm altus. Pistillum ca. 11 mm longum; ovario lineari, ca. 6 mm longo, 1mm lato, cum stylo basi puberulo et glandulose-puberulo; stigmate lineari, ca. 1.8 mm longo, 1 mm lato, apice 2-lobulato. Capsulae juvenales lineares, ca. 11 mm longae.

Herbs perennial, stemless. Rhizome ca. 1.5 cm, apex ca. 6 mm diam. Leaves ca. 4, basal, petiole 2.5–3 cm, flattened, pilose; leaf blade strongly oblique, ovate to ovate-elliptic, 3–9 × 2–3.3 cm, herbaceous, both surfaces appressed pilose (hairs 1–1.2 mm) and puberulous (hairs 0.2–0.5 mm); base cuneate on one side, rounded on the other, margin repand denticulate, apex minutely acute; lateral veins 3–4 pairs. Cymes 1–2, 6–8 cm, 1 ×

branched, 1–2-flowered; bracts 2, opposite, oblong-lanceolate, 8–9 × ca. 2 mm, both surfaces appressed puberulous, margin sparsely denticulate, apex minutely acute; pedicel 0.7–1 cm, pilose. Calyx 5-sect, segments slightly unequal, elliptic-lanceolate, 7–7.5 × 1.8–2.1 mm; abaxial surface brown, pilose; adaxial surface green, glabrous; margin 4–6-denticulate above the base, apex acute to obtuse. Corolla fleshy, ca. 2.3 cm, abaxially glandular puberulous, adaxially pilose near base; tube subtubular, ca. 12 mm, mouth ca. 6 mm diam.; upper lip 2-lobed, ca. 3 mm; lower lip 3-lobed, ca. 11 mm, lobes semiorbicular. Stamens 2, adnate to corolla tube for ca. 8 mm; filaments ca. 8 mm, glabrous, geniculate near middle; anthers ca. 3.5 mm, glabrous. Staminodes 2, adnate to corolla tube for ca. 6 mm, linear, ca. 1.5 mm, glabrous, apex capitate. Disc ring-like, ca. 0.5 mm. Pistil ca. 1.1 cm; ovary linear, ca. 6 × 1 mm, puberulous and glandular puberulous; style base puberulous and glandular puberulous; stigma linear, ca. 1.8 × 1 mm, apex 2-lobed. Immature capsule linear, ca. 1.1 cm.

Distribution and ecology. This species is found only in the province of Gansu in Wenxian at Bikou, on a cliff in a valley, growing at 900 m elevation and flowering in April. The species is named in honor of Laurence E. Skog.

Chirita wangiana Z. Y. Li, sp. nov. (*Chirita* sect. *Gibbosaccus*). TYPE: China. Guangxi: Liuzhou, cultivated in Longtan Park conservatory, alt. 150 m, introduced from Rong-an, 15 July 1992, *Li Zhen-yu 11001* (holotype, PE).

A *C. sclerophyllae* W. T. Wang in foliis 2–4 cm longis 1.4–3.5 cm latis; cymis 1–3-floris, pedunculis 4–4.5 cm longis, flore nutanti; calycis segmentis ca. 3 mm longis, 0.8 mm latis; corolla intus glabra; filamentis ca. 5 mm supra basin corollae insertis; stigmate ca. 3 mm longo differt.

Herbs perennial, stemless. Rhizome terete, to 1.7 cm, 1 cm diam. Leaves to 24, crowded at apex of rhizome, opposite, petiolate; blades ovate or orbicular, 2–4 × 1.4–3.5 cm, thick papery when dry, adaxial surface dark green, shiny, abaxial surface purple, both sides sparsely appressed puberulous, base obtusely rounded or rounded, margin remotely repand-crenate, apex rounded, lateral veins 3–4 pairs, conspicuous; petioles 0.4–1.2 × 0.3–0.4 cm, abaxially densely villous. Inflorescences of ca. 4 cymes from the axils of the crowded leaves, each 1–3-flowered; peduncle 4–4.5 cm, densely purple puberulous and glandular puberulous; bracts 2, linear, 3–4 × ca. 0.4 mm, margin entire, purple glandular ciliate; pedicel ca. 3 mm, purple puberulent, glandular puberulous. Flowers nutant; calyx 5-lobed to base, each segment lanceolate-linear, ca. 3 × 0.8 mm, puberulous outside, glabrous inside, margin entire, apex subulate-acuminate; corolla white, ca. 3.5 cm, sparsely puberulous and glandular puberulous outside, inside glabrous, tube ca. 2.5 cm, ca. 1 cm diam. at mouth, limb patent, interior surface purplish, upper lip ca. 5 mm, 2-lobed, each lobe broadly ovate, lower lip ca. 10 mm, 3-lobed, each lobe ovate, flat; stamens 2, filaments lanceolate-linear, adnate for 5 mm to the base of the corolla, ca. 14 mm, ca. 1 mm wide basally, ca. 0.2 mm wide apically, geniculate above base, glabrous, anthers ca. 3 mm, puberulous, staminodes 2, linear, ca. 4 mm, glabrous; disc annular, ca. 1 mm high, glabrous; pistil ca. 2.7 cm, densely puberulous and glandular puberulous, ovary linear, ca. 17 × 0.9 mm; lower lip of stigma obtrapezoidal, ca. 3 mm, 2-lobed, each lobe ovate-lanceolate. Fruit unknown.

Distribution and ecology. Plants only known from the province of Guangxi from which they were brought into cultivation. Flowering occurs at least in July. The species is named in honor of Wang Wen-tsai.

Didymocarpus subpalmatinervis W. T. Wang, sp. nov. TYPE: China. Yunnan: Y-dje, near Lou-lan, July 1909 (fl), *Fr. Ducloux 3711* (holotype, P).

Herba perennis, acaulescens. Rhizoma breve, radices 3–4 crassas edens. Folia basalia, ca. 4; laminae papyraceae, cordato-ovatae vel cordatae, 2–4.5 cm longae, 1.8–5.4 cm latae, basi cordatae, apice obtusae, margine obtuse dentatae vel duplicato-dentatae, supra dense adpresse puberulae, subtus ad nervos pilosae, nervis basalibus 3–4, lateralibus utrinsecus 3–4. Cymae ca. 2, bis ramosae, 2–10-florae; pedunculus 4.5–11 cm longus, puberulus; bracteae 2–3, anguste lanceolatae vel lineares, 4–7 mm longae, 0.6–1.5 mm latae, puberulae; pedicelli 2.5–11 mm longi, puberuli. Calyx 5-sectus, segmentis lineari-triangularibus, 5.2–7 mm longis, 1–1.2 mm latis, extus puberulis, intus glabris, apice attenuatis obtusiusculis. Corolla flava, 2–2.5 cm longa, extus dense puberula, intus ad lobos puberula; tubo infundibuliformi-cylindrico, 1.4–1.7 cm longo, supra basin leviter arcuato, ore 3–4 mm diam.; labio supero 3–4 mm longo, 2-lobato, labio infero 5–6 mm longo, 3-partito, lobis triangularibus. Stamina fertilia 2, corollae tubo 8–10 mm adnata; filamentis anguste linearibus, ca. 5.5 mm longis, minute puberulis; antheris ellipsoideis, ca. 1.5 mm longis, glabris; staminodia 2, corolla tubo ca. 6.5 mm adnata, filiformia, ca. 0.6 mm longa, glabra. Discus annularis, ca. 0.4 mm altus. Pistillum ca. 14 mm longum; ovario lineari, 4 mm longo, dense puberulo; stylo ca. 9 mm longo, sparse puberulo; stigmate depresse capitato, ca. 0.7 mm diam.

Perennial, stemless herb. Rhizome short, with ca. 3–4 robust roots. Leaves ca. 4; petiole flat 0.4–7.5 × 0.15–0.3 cm spreading pubescent; leaf blade ovate to oblate, 2–4.5 × 1.8–5.4 cm, papery, adax-

ially densely appressed puberulous, abaxially appressed puberulous, pilose on veins; base cordate, margin obtusely or doubly dentate, apex obtuse; basal veins 3–4, lateral veins 2–3 pairs. Cymes ca. 2, ca. 2 × branched, 2–10-flowered; peduncle 4.5–11 cm, puberulous; bracts 2–3, narrowly lanceolate or linear, 4–7 × 0.6–1.5 mm, puberulous, margin entire. Pedicel 2.5–11 mm, puberulous. Calyx actinomorphic, 5-sect or nearly so, segments linear-triangular, 5.2–7 × 1–1.2 mm, both surfaces puberulous; margin entire, apex attenuate. Corolla yellow, 2–2.5 cm, outside densely puberulous, lobes puberulous inside; tube funnelform-cylindric, 1.4–1.7 cm, slightly arcuate-curved above base, mouth 3–4 mm diam., upper lip 3–4 mm, 2-lobed, lower lip 5–6 mm, 3-lobed, all lobes triangular. Stamens 2, adnate to corolla tube for 8–10 mm above base, ca. 7 mm; filaments linear, minutely puberulous; anthers ellipsoid, ca. 1.5 mm, glabrous; staminodes 2, adnate to corolla tube for ca. 6.5 mm above base, filiform, ca. 0.6 mm, glabrous. Disc annular, 0.4 mm. Pistil ca. 14 mm; ovary linear, ca. 4 × 0.5 mm, densely puberulous; style ca. 9 mm, sparsely puberulous; stigma depressed capitate, ca. 7 mm diam.

This species is most similar to *Didymocarpus heucherifolius*, from which it can be distinguished by its smaller leaves (3–9 × 3.5–11 cm in *D. heucherifolius*), calyx 5-sect or nearly so (unequally 5-lobed in *D. heucherifolius*), yellow corolla (red in *D. heucherifolius*), shorter corolla tube (1.4–1.7 cm in *D. subpalmatinervis* vs. 1.8–2.2 cm in *D. heucherifolius*), and glabrous anthers (anthers puberulous in *D. heucherifolius*).

Hemiboea subcapitata C. B. Clarke var. **guangdongensis** (Z. Y. Li) Z. Y. Li, comb. nov. Basionym: *Hemiboea henryi* C. B. Clarke var. *guangdongensis* Z. Y. Li, as "*guandongensis*," Acta Phytotax. Sin. 25: 225. 1987. TYPE: China. Cultivated at the South China Institute of Botany, introduced from N Guangdong, *W. T. Wang 83-3* (holotype, PE).

Because *Hemiboea henryi* is included as a synonym of *H. subcapitata* in the *Flora of China* treatment, this new combination is needed.

Hemiboea wangiana Z. Y. Li, sp. nov. (*Hemiboea* C. B. Clarke sect. *Hemiboea*). TYPE: China. Yunnan: Gejiu, Man-Hao, Qingshushe, 280 m, 24 Dec. 1993, *Shui Yu-min 004004* (holotype, PE).

A *H. gamosepala* Z. Y. Li in bracteis ca. 1 cm diam., calyce ca. 2.5 cm longo, corolla alba, pistillo ca. 2.6 cm differt.

Herbs perennial, caulescent. Stolons unknown. Stems up to 60 cm, 5 mm diam., branched, with 7 to many nodes, dark purple spotted, glabrous. Petiole 0.5–4 cm, glabrous, not winged, free at base; leaf blade ovate to elliptic, 3–10 × 1–4 cm; herbaceous when dry, adaxial surface dark green, abaxial surface pale green, glabrous; base oblique, cuneate to rounded; margin repand, serrulate, or subentire; apex cuspidate or acuminate; sclereids surrounding vascular bundles vermiform and basilliform; lateral veins 5–8 pairs. Inflorescences pseudoterminal cymes, 3(or 2)-flowered; peduncles 0.6–1.2 cm, glabrous; involucre globose, apex subulate, ca. 1 cm diam., pale green, glabrous; pedicel 3–4 mm, glabrous. Calyx white, ca. 2.5 cm, connate for ca. ¾, lobes ovate-triangular, 3–4 × 2–3 mm, membranaceous, glabrous. Corolla white, upper side purple spotted, 3.7–4.1 cm, tube 2.8–3 cm, 1.1–1.2 cm diam. at mouth, outside sparsely glandular puberulous, inside with a ring of hairs 5–8 mm above the tube base, upper lip 6–7 mm, 2-lobed, lobes broadly ovate, lower lip 9–11 mm, 3-lobed, lobes ovate. Stamens 2; filaments adnate to the corolla base for ca. 14 mm, linear, 14–15 mm; anthers ovate to orbicular, ca. 2.5 mm, coherent adaxially; staminodes 2, ca. 8 mm. Disc ca. 1.8 mm. Pistil ca. 2.6 cm, glabrous; ovary linear-lanceolate, ca. 9 × 1.8 mm; stigma subcapitate.

Hemiboea wangiana is related to *H. gamosepala* Z. Y. Li, but it is distinguished by having a smaller involucre (ca. 1 cm vs. 1.8–2.3 cm diam.), a larger calyx (ca. 2.5 cm vs. 1.4–1.6 cm), a white corolla (vs. pink), and a longer pistil (ca. 2.6 vs. ca. 1.5 cm). The species is named in honor of Wang Wentsai.

Distribution and ecology. On streamside rocks. Altitude ca. 280 m.

Lysionotus microphyllus W. T. Wang var. **omeiensis** (W. T. Wang) W. T. Wang, comb. et stat. nov. Basionym: *Lysionotus omeiensis* W. T. Wang, Guihaia 3: 271, pl. 1, figs. 1–2. 1983. TYPE: China. Sichuan: Emei shan, Hongchun ping, Yu'anfeng, 20 Sep. 1952, *J. H. Xiung, X. S. Zhang & X. L. Jiang 32767* (holotype, SZ).

When W. T. Wang described *Lysionotus microphyllus* and *L. omeiensis* (Wang, 1983b), he stated that the two species are "very closely related." Both taxa are small shrubs with very small leaves (8.5–11 × 5–6 mm). We now consider these taxa to belong to a single species with two varieties, which can be distinguished by the following key:

1a. Leaves opposite, in whorls of 3, or alternate; leaf blade glabrous on both surfaces, margin 1–3-denticulate; calyx ca. 1.5 mm, segments triangular . . . . . var. *microphyllus*
1b. Leaves opposite or alternate; leaf blade adaxially puberulous near margin, abaxially glabrous, margin 1–2-crenate or subentire; calyx ca. 4 mm, segments triangular-linear . . . . . var. *omeiensis*

Lysionotus pauciflorus Maximowicz var. **ikedae** (Hatusima) W. T. Wang, comb. et stat. nov. Basionym: *Lysionotus ikedae* Hatusima, Mem. Fac. Agric. Kagoshima Univ. 7: 324, pl. 1. 1970. TYPE: China. Taiwan: Botel Tobago Island (Kôtôsyo or Lanyu Island), 1968, *G. Ikeda 2246* (holotype, herbarium not indicated, not seen).

Hatusima (1970) suggested that *Lysionotus ikedae* was most closely related to *L. brachycarpus* Rehder (currently a synonym of *L. heterophyllus* Franchet). He also compared his species to *L. pauciflorus*, which he thought had narrower leaves and larger flowers. Upon careful examination of *L. pauciflorus* from throughout its range, it is clear that several species and varieties of *Lysionotus* D. Don recognized in Wang et al. (1990: *L. carnosus* Hemsley, *L. hainanensis* Merrill & W. Y. Chun, *L. montanus* Kao & Devol, *L. pauciflorus* var. *lancifolius* W. T. Wang, *L. pauciflorus* var. *latifolius* W. T. Wang, and *L. pauciflorus* var. *linearis* Rehder) fit in a continuum of variation, which we now recognize as *L. pauciflorus* var. *pauciflorus*. According to the description of *L. ikedae*, it fits well into *L. pauciflorus*, but it has the otherwise unknown character of corolla basally puberulous outside. Since none of us has seen this character in any other specimen of *L. pauciflorus*, we have chosen to give this taxon varietal status. We have not been able to obtain the type for study.

Opithandra burttii W. T. Wang, sp. nov. TYPE: China. Jiangxi: Longnan, Linwu Village, Mt. Wuzhishan, on rocks in forests, 1–25 Oct. 1934 (fl), *S. K. Lau 4622* (holotype, GH; isotypes, BM, IBSC, US).

Herba perennis, acaulescens. Rhizoma teres, ca. 2 cm longum. Folia basalia, ca. 10, interiora sessilia, exteriora breviter longeve petiolata; laminae papyraceae, ellipticae vel oblongae, 2.5–8 cm longae, 1.7–4 cm latae, basi subcordatae, apice obtusae vel rotundatae, margine crenulatae, supra dense albo-puberulae, subtus adpresse puberulae et ad nervos brunneo-sericeo-lanatae, nervis lateralibus utrinsecus 6–8; petioli robusti, 0.5–5.4 cm longi, brunneo-sericeo-lanati. Cyma ca. 1, semel vel bis ramosa, 2–7-flora; pedunculus 2–6 cm longus, puberulus; bracteae 2, oppositae, lineares, ca. 3 mm longae, 0.7 mm latae, sparse puberulae; pedicelli 3–12 mm longi, pubescentes. Calyx 5-sectus, segmentis linearibus, 3.5–3.8 mm longis, ca. 1 mm latis, extus puberulis intus glabris apice obtusiusculis. Corolla purpurea, 1.6–2.2 cm longa, extus sparse puberula, intus glabra; tubo tubulari, 10–14 mm longo, ore ca. 3.5 mm diam.; labio supero 4–6 mm longo, 2-lobato, labio infero 5–7 mm longo, 3-lobato. Stamina corollae tubo 5–7 mm adnata, glabra; filamentis anguste linearibus, 3.5–5.5 mm longis; antheris liberis, oblongis, ca. 2 mm, glabris; staminodia nulla. Discus annularis, ca. 0.8 mm altus. Pistillum ca. 6.5 mm longum, glabrum; ovario ca. 5 mm longo; stylo 1 mm longo; stigmatibus 2, ca. 0.5 mm longis.

Herbs perennial, acaulescent. Rhizome terete, ca. 2 cm. Leaves basal, ca. 10, innermost sessile, outer ones short-petiolate, petiole robust, 0.5–5.4 cm, brownish sericeous-lanate; lamina elliptic to oblong, 2.5–8 × 1.7–4 cm, papery, upper surface densely white puberulous, lower surface appressed puberulous between veins and brown sericeous-lanate mainly on veins; base subcordate, apex obtuse to rounded, margin crenulate; lateral veins 6–8 pairs. Cyme ca. 1, 1 or 2 × branched, 2–7-flowered; peduncle 2–6 cm, puberulous; bracts 2, opposite, linear, ca. 3 × 0.7 mm, sparsely puberulous; pedicel 3–12 mm, pubescent. Calyx 5-sect, segments linear, 3.5–3.8 × ca. 1 mm, outer surface puberulous, inner surface glabrous, apex minutely obtuse. Corolla purple, 1.6–2.2 cm, outer surface sparsely puberulous, inside glabrous, tube tubular, 10–14 mm, mouth ca. 3.5 mm diam., upper lip 2-lobed, 4–6 mm, lower lip 3-lobed, 5–7 mm. Stamens adnate to corolla tube for 5–7 mm, glabrous; filaments narrowly linear, 3.5–5.5 mm, anthers free, oblong, ca. 2 mm, with straight slits; staminode absent. Disc ring-like, ca. 0.8 mm. Pistil ca. 6.5 mm, glabrous; ovary ca. 5 mm, style ca. 1 mm, stigmas 2, ca. 0.5 mm.

This species was suggested and included in a key by Burtt (1958) as "*Opithandra* sp. nov. ?" based on the same collection. Based on the duplicates that we have seen, it clearly is a different species, related to *Opithandra sinohenryi*, but differs from it in having brown sericeous-lanate indument mainly or only on the veins, a smaller calyx, the corolla glabrous inside, and staminode absent. The species is named in honor of B. L. Burtt.

Oreocharis aurea Dunn var. **cordato-ovata** (C. Y. Wu ex H. W. Li) K. Y. Pan, A. L. Weitzman & L. E. Skog, comb. et stat. nov. Basionym: *Oreocharis cordato-ovata* C. Y. Wu ex H. W. Li, Bull. Bot. Res., Harbin 3(2): 7, photo. 4. 1983. TYPE: China. Yunnan: Si-chou-hsien [Xichour], Shiang-pyng shan [Xiangpingshan], 1400–1500 m, ad saxas prope fluminem, floribus aureis, 29 Aug. 1947, *K. M. Feng 11432* (holotype, KUN; isotypes, A, KUN, PE, SCBI).

Oreocharis cordato-ovata is very closely related to *O. aurea*. The characters that differentiate them are leaf blade and margin shape and calyx segment margin shape (leaf blade cordate-ovate, margin crenate; calyx lobes entire in the former vs. leaf blade elliptic-ovate, margin doubly serrate; calyx lobes 2–3-dentate near apex in the latter). The leaf blade shape is very similar on the specimens of the two species, and we have seen overlap in this character. Indeed, the only character that clearly separates them is the denticulate calyx segments in *O. aurea*. For this reason we now recognize *Oreocharis cordato-ovata* as a variety of *O. aurea*.

Oreocharis dentata A. L. Weitzman & L. E. Skog, sp. nov. TYPE: China. W Sichuan: Sep. 1908, *E. H. Wilson 2256* (holotype, GH; isotypes, K, US). Figure 1.

Ab *Oreochari aurantiaca* Franchet in foliis late ovatis vel fere rhombeis et bracteis persistentis, differt.

Herbs, perennial, stemless, subrhizomatous, rhizome ca. 7 mm diam. Leaves up to 15, basal; petiole to 3.7 cm, epidermis drying green, densely red-brown long-villous; leaf blade broadly ovate to nearly rhombic, 2.5–6 × 2–4.8 cm; epidermis drying green, adaxially densely whitish pubescent to villous; abaxially red-brown villous to woolly, hairs longer on veins; base sometimes slightly oblique, cuneate to cordate, margin coarsely dentate to coarsely crenate or serrate, sometimes also denticulate, apex acute, rarely to rounded, lateral veins 5 or 6 pairs, distinct. Cymes unbranched or 1 × branched, lax, 1–4-flowered; peduncle 4–9 cm, epidermis drying reddish brown, translucent to golden villous; bracts 2, narrowly triangular, 3–5 × ca. 1 mm, villous to densely pubescent, margin entire. Pedicel 1.1–2 cm, epidermis drying reddish brown, translucent to golden villous. Calyx drying purplish near margin, actinomorphic, 5-sect from base, segments equal, narrowly triangular, 4–6 × 1–1.5 mm, outside densely villous, inside sparsely villous, margin entire. Corolla drying orange, lobes red, zygomorphic, 1.9–2.4 cm; outside densely glandular pubescent, especially on lobes, inside glabrous, tube cylindric, slightly gibbous on adaxial side, narrowing slightly toward throat, 1.5–1.8 × 0.4–0.7 cm; limb 2-lipped, adaxial lip shallowly 2-lobed, lobes oblong, 3–4 × ca. 2 mm, apex rounded; abaxial lip deeply 3-lobed, lobes unequal, central lobe lanceolate, ca. 7.5 × 2 mm, lateral lobes oblong, ca. 6 × 2.5 mm, apex rounded. Stamens 4, adnate to 7–12 mm above corolla base, 7–8 mm; filaments slender, glabrous or pubescent; anthers basifixed, free, broadly oblong, 2.5–3 mm, 2-loculed, thecae parallel, not confluent, dehiscing longitudinally, connective not projecting, glabrous or pubescent; staminode 1, adnate to adaxial side of corolla tube, ca. 1.2 mm. Disc ringlike, ca. 2 mm, 5-lobed, undulate. Pistil drying purplish, ca. 1.3 cm, glabrous; ovary narrowly oblong, ca. 9 × 2 mm; stigma 1, disc-shaped. Capsule fusiform, 2.8–4 × 0.3–0.4 cm. Flowering in September.

This new species, *Oreocharis dentata*, differs from all other species of *Oreocharis* in the combination of its moderately small, broadly ovate to nearly rhombic leaf blade, margin coarsely dentate (or coarsely crenate to serrate), few-flowered cymes, and stamens adnate to near the middle of the corolla tube. It is most similar to *O. aurantiaca* (which includes *O. cordatula* (Craib) Pellegrin and *O. minor* (Craib) Pellegrin in the opinion of Weitzman and Skog but will be recognized in the *Flora of China* according to the preferences of the Chinese author), but it differs in the broadly ovate to nearly rhombic leaf blade (narrowly ovate or rhombic-ovate to narrowly elliptic or lanceolate in *O. aurantiaca*) and persistent bracts (deciduous in *O. aurantiaca*).

Paraboea glutinosa (Handel-Mazzetti) K. Y. Pan, comb. nov. Basionym: *Boea glutinosa* Handel-Mazzetti, Sinensia 7: 620. 1936. TYPE: China. Guangxi: Nee Pai [Ni-bai], border with Guizhou, 700 m, 29 June 1928, *R. C. Ching 6317* (holotype, WU not seen; photo at US).

This species belongs in *Paraboea* because of its 4-valved capsules and branching, interwoven, woolly indument. *Boea*, as currently delimited, has 2-valved capsules and variable indumentum that does not branch and is not interwoven and woolly.

Paraisometrum W. T. Wang, gen. nov. TYPE: *Paraisometrum mileense* W. T. Wang. Figure 2.

Herbae perennes, acaulescentes, rhizomatibus brevibus. Folia omnia basalia, petiolata, elliptica, margine denticulata, penninervia. Cymae axillares, longe pedunculatae, pauciflorae, 2-bracteatae. Calyx campanulatus, 5-sectus. Corolla bilabiata, tubo infundibuliformi-tubulari limbo multo longiore; labio supero inaequaliter 4-lobato, lobis triangularibus, interioribus 2 minoribus, exterioribus 2 majoribus; labio infero indiviso deltato-ovato. Stamina fertilia 4, inclusa, leviter supra corollae tubi medium adnata; filamentis anguste linearibus; antheris per paria cohaerentibus, ellipsoideis, thecis parallelis; staminodium dorsali-medianum, parvum supra corollae basin adnatum, anguste lineare. Discus annularis. Pistillum inclusum, ovario lineari, placentis parietalibus duabus intrusis deinde valde divaricatis ovuligeris, stylo brevi, stigmate parvo depresse capitato.

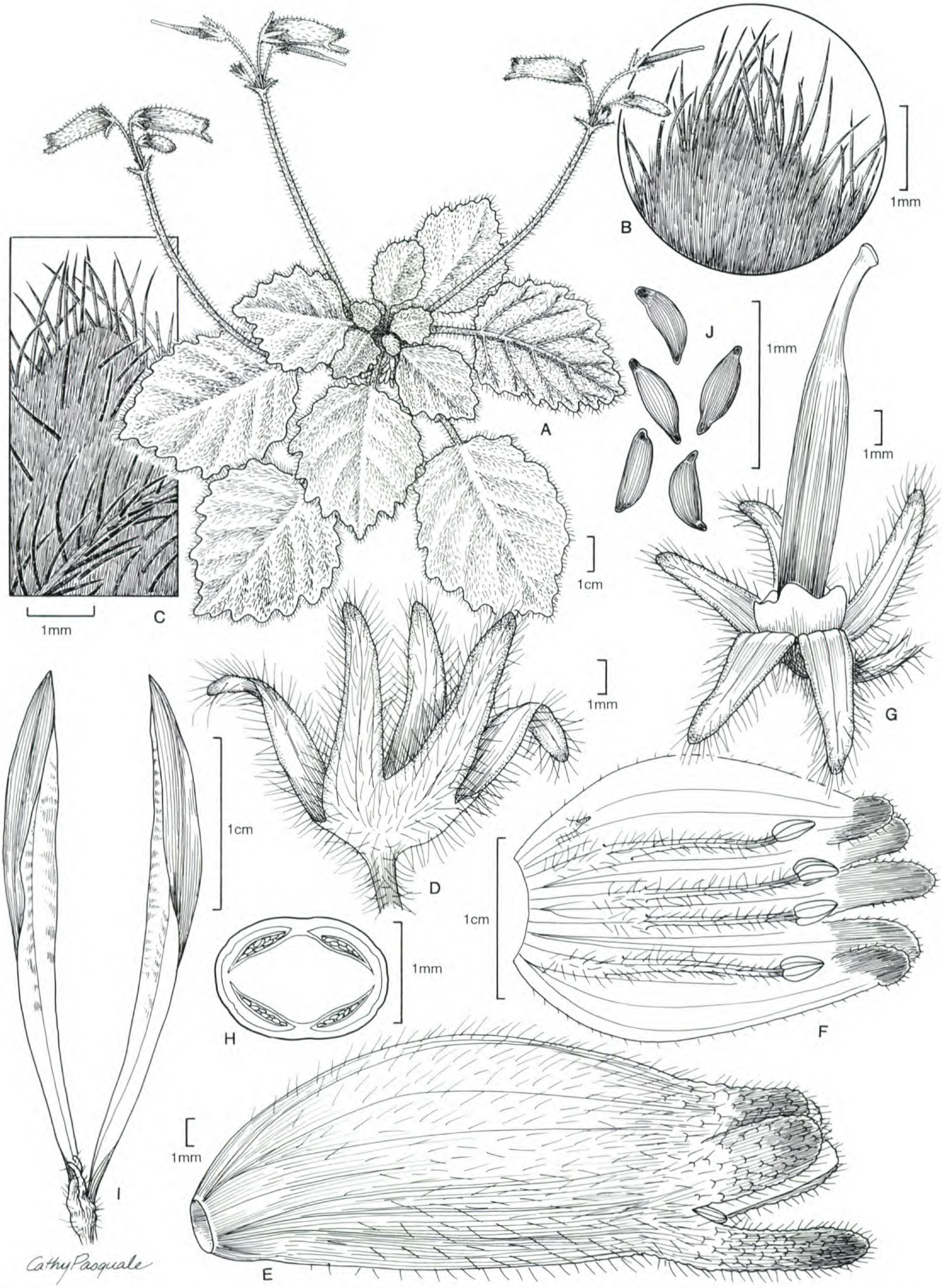

Figure 1. *Oreocharis dentata* A. L. Weitzman & L. E. Skog. —A. Habit. —B. Upper leaf surface. —C. Lower leaf surface. —D. Calyx. —E. Corolla exterior. —F. Opened corolla with stamens and staminode. —G. Pistil with calyx and disc. —H. Capsule cross section. —I. Dehisced capsule. —J. Seeds. (All from *Wilson 2256.*)

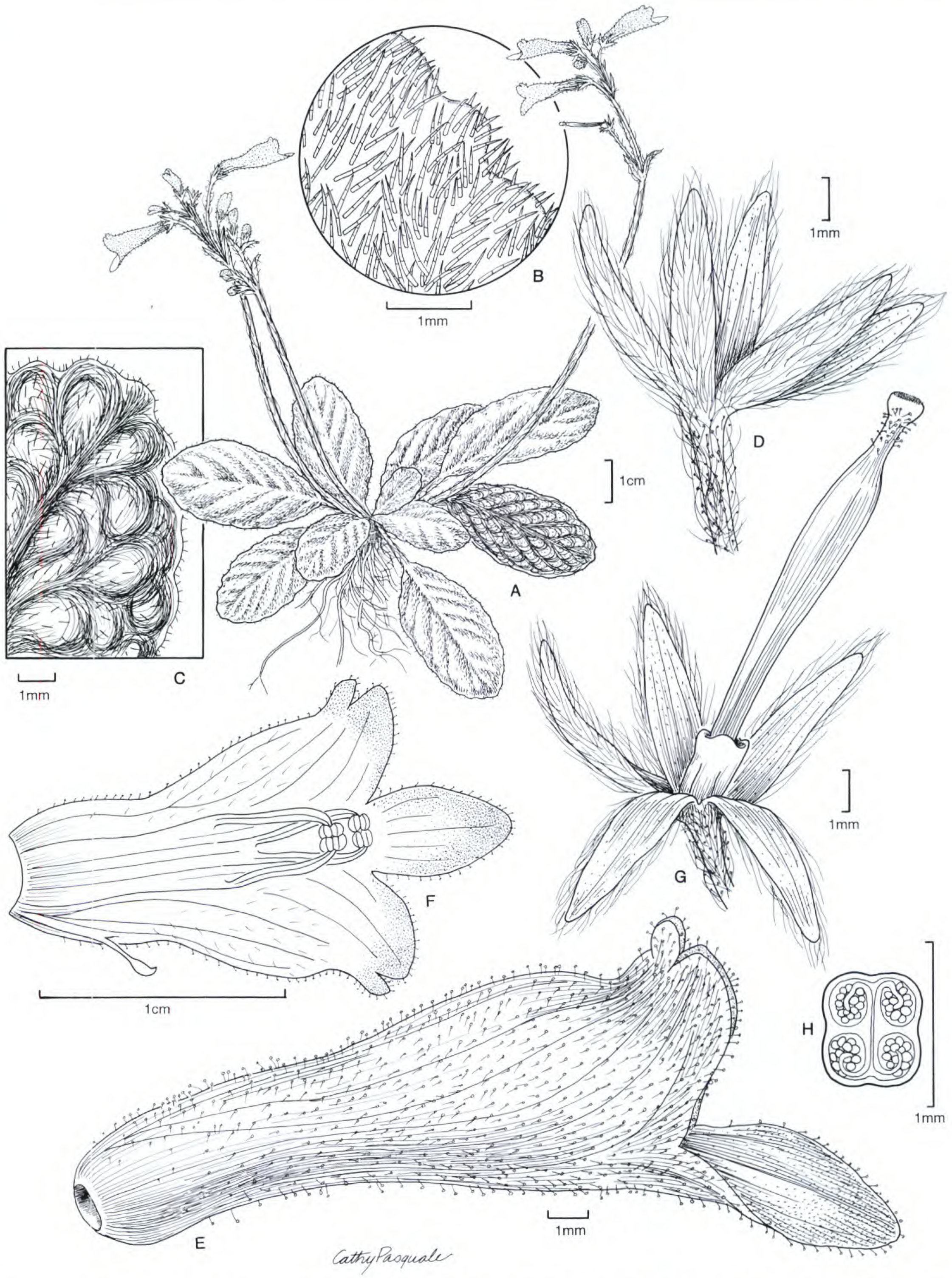

Figure 2. *Paraisometrum mileense* W. T. Wang. —A. Habit. —B. Upper leaf surface. —C. Lower leaf surface. —D. Calyx. —E. Corolla exterior. —F. Opened corolla with stamens and staminode. —G. Pistil with calyx and disc. —H. Young fruit cross section. (All from *F. Ducloux 4151*.)

Herbs, perennial, stemless. Rhizome short. Leaves basal, petiolate, elliptic, margin denticulate, pinnately veined. Cymes axillary, long pedunculate, few-flowered, bracts 2, opposite. Calyx actinomorphic, campanulate, 5-sect. Corolla bilabiate, tube infundibuliform-tubular, longer than limb, upper lip unequally 4-lobed, lobes triangular, central 2 smaller than outer 2; lower lip undivided, deltate-ovate. Fertile stamens 4, included, adnate to above the middle of corolla tube; filaments narrowly linear, anthers coherent in pairs by their adaxial surfaces, thecae parallel; staminode 1, adnate to above the base of the upper-central side of corolla tube, narrowly linear. Disc ring-like. Pistil included, ovary linear, 1-loculed; placentas 2, parietal, projecting inward, 2-cleft; style short, stigma 1, small, depressed-capitate.

One species, restricted to southeastern Yunnan, China.

Paraisometrum appears most closely related to *Isometrum*. Both genera share the presence of 4 fertile stamens, the corolla limb much shorter than the corolla tube, and the 5 corolla lobes nearly equal in length. The genus *Isometrum* is restricted to southwestern and central China. *Paraisometrum* differs from *Isometrum* in its corolla with a 4-lobed upper lip and an undivided lower lip, stamens that are adnate to above the middle of the corolla tube, and the pistil with one stigma.

Paraisometrum mileense W. T. Wang, sp. nov. TYPE: China. Yunnan: Mile Xian, Lau-kouy chan, 9 Feb. 1906, *F. Ducloux 4151* (holotype, P). Figure 2.

Herba perennis. Rhizoma breve, 0.5–1 cm crassum. Folia basalia, 7–10; laminae ellipticae vel oblongo-ellipticae, 2–4.8 cm longae, 1.2–1.8 cm latae, coriaceae, supra dense adpresse albo-pubescentes, subtus brunneolo-lanatae, nervis lateralibus utrinsecus 5–6, supra impressis, subtus promulis, basi cuneateae vel obtusae, margine obtuse denticulatae, apice obtusae vel rotundatae. Cymae 1–3, semel vel bis ramosae, 3–8-florae; pedunculus 6.5–12 cm longus, dense brunneolo-pubescens; bracteae 2, oppositae, lanceolato-lineares, 7–10 mm longae, 1.2–3 mm latae, extus brunneolo-lanatae, intus glabrae; pedicelli 0.6–2.2 cm, puberuli et glanduloso-puberuli. Calyx 5-sectus, segmentis lanceolato-linearibus, 3–5.2 mm longis, 0.8–1 mm latis, extus dense puberulis, intus glabris, apice acutis. Corolla purpurea, 1.6–1.8 cm longa, extus glanduloso-puberula, intus ad lobos dense minuteque puberula; tubo 1.3–1.4 cm longo, ore 3.5–5 mm diametro; labio supero 3–4 mm longo, 8.5 mm lato, lobis interioribus 2 ca. 1.2 mm longis, 1 mm latis, exterioribus 2 ca. 1.6 mm longis, 2 mm latis; labio infero ca. 2.2 mm longo, 3 mm lata. Stamina corollae tubo ca. 9 mm adnata, glabra; filamentis ca. 5 mm longis; antheris ca. 0.8 mm longis; staminodium corollae tubo ca. 2.2 mm adnatum, ca. 0.8 mm longum, glabrum. Pistillum ca. 10 mm longum, glabrum; ovario ca. 9 mm longo, 1 mm lato; stylo ca. 1 mm longo; stigmate parvo.

Herbs perennial, stemless, short rhizomatous. Leaves basal, 7–10; petiole 0.2–4.2 cm, brownish lanate; leaf blade elliptic to oblong-elliptic, 2–4.8 × 1.2–1.8 cm, leathery, adaxially densely appressed white pubescent, abaxially densely brownish lanate; base cuneate to broadly cuneate, margin obtusely denticulate, apex obtuse to rounded; lateral veins 5 or 6 pairs, adaxially impressed, abaxially slightly prominent. Cyme 1–3, branched 1 or 2 ×, 3–8-flowered; peduncle 6.5–12 cm, densely brownish pubescent; bracts lanceolate-linear, 7–10 × 1.2–3 mm, outside densely brownish lanate, inside glabrous. Pedicel 0.6–2.2 cm, puberulous and glandular-puberulous. Calyx segments lanceolate-linear, 3–5.2 × 0.8–1 mm, outside densely puberulous, inside glabrous, apex acute. Corolla purple, 1.6–1.8 cm, outside glandular-puberulous, inner surface of lobes densely minutely puberulous; tube funnelform-tubular, 1.3–1.4 cm, mouth 3.5–5 mm diam.; upper lip 3–4 × ca. 8.5 mm, 4-lobed, lobes triangular, central 2 smaller, ca. 1.2 × 1 mm, lateral 2 larger, ca. 1.6 × 2 mm; lower lip undivided, deltoid, ca. 2.2 × 3 mm. Stamens adnate for 9–10 mm above corolla base, glabrous; filaments narrowly linear, ca. 5 mm; anthers coherent in pairs, ellipsoid, ca. 0.8 mm; staminode adnate for ca. 2.2 mm above corolla base, filiform, ca. 0.8 mm, glabrous. Pistil ca. 10 mm, glabrous; ovary linear, ca. 9 × 1 mm; style ca. 1 mm; stigma depressed-capitate.

Tengia scopulorum W. Y. Chun var. **potiflora** (S. Z. He) W. T. Wang, A. L. Weitzman & L. E. Skog, comb. et stat. nov. Basionym: *Tengia potiflora* S. Z. He, in S. Z. He & X. D. Cong, J. China Pharm. Univ. 23: 269. 1992. TYPE: China. Guizhou: Xiuwen Xian, Maochong, 1200 m, 22 July 1991, *S. Z. He 91052* (holotype, HGCM; isotype, PE).

Ecology. On limestone cliffs. Altitude ca. 1200 m.

This plant differs from *Tengia scopulorum* var. *scopulorum* in several characters; however, in our opinion the differences are not enough to merit species rank. The differences are summarized in the following key:

1a. Corolla white or pink, 5–7 mm, tube 3.8–4 mm, lobes 1.2–3 mm; style 4–5 mm . . . var. *scopulorum*
1b. Corolla purple, 10.3–11.3 mm, tube 9–10 mm, lobes ca. 1.3 mm; style 7–9 mm . . . . var. *potiflora*

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Natural History Biodiversity Office and Office of Fellowships and Grants, Missouri Botanical Garden, and by a special fund of the president of Chinese Academy of Science. B. L. Burtt and John Boggan have given us helpful comments on all aspects of the Gesneriaceae treatment for the *Flora of China*; Peter Stevens assisted with the Latin diagnosis for *Oreocharis dentata*. Cathy Pasquale prepared the illustrations of *Oreocharis dentata* and *Paraisometrum mileense*.

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Sextonia, a New Genus of Lauraceae from South America

Henk van der Werff
Missouri Botanical Garden, P.O. Box 299, St. Louis, Missouri 63166-0299, U.S.A.

ABSTRACT. The genus *Sextonia* is described; it consists of two species, the rather widespread *S. rubra* and the new species *S. pubescens*, restricted to eastern Peru.

Ocotea is the largest genus of neotropical Lauraceae, including at least 300 species (van der Werff, 1991). It is not surprising that with such a large number of species the genus shows considerable morphological variation, is difficult to delimit, and is in much need of a modern revision. Oftentimes the genus has been used to accommodate species that could not be adequately placed in other, better defined genera. As information from other disciplines, most notably wood and bark anatomy (Richter, 1981), has become available, some of the anomalous species have been removed from *Ocotea* and recognized as distinct genera. Rohwer et al. (1991) created the genus *Chlorocardium* for two species previously placed in *Ocotea* and discussed some other problematical species. I propose to recognize one of those species, until now treated as *Ocotea rubra*, as belonging to a distinct genus and will describe a new species of this genus as well.

Sextonia van der Werff, gen. nov. TYPE: *Sextonia rubra* (Mez) van der Werff. Figure 1.

Arbores magnae. Folia ad apices ramulorum aggregata. Inflorescentiae axillares, racemosae vel paniculatae. Tepala 6, inaequalia, 3 exteriora quam 3 interiora minora, erecta; stamina 9, 4-locellata, 6 exteriora locellis in arcu non profundo dispositis, 3 interiora locellis in 2 paribus superpositis; staminodia 3; receptaculum profundum. Fructus cupula insidens, ab ea ⅓ vel fere omnino obtecta.

Large trees, to 45 m tall. Twigs thick, corky, terete. Leaves alternate, clustered near the tips of the branches, pinnately veined, without domatia. Inflorescences axillary, racemose or paniculate, ultimate divisions of inflorescences frequently not strictly cymose, but racemose. Tepals erect, unequal, the outer three smaller than the inner three; stamens 9, 4-celled, the outer 6 with the cells in a shallow arc, the inner 3 with the cells placed in two pairs, the filaments short, as wide as the anthers, staminodia 3; receptacle deep. Fruit initially enclosed in the cupule, at maturity either ⅔ exserted or almost completely enclosed in the cupule.

The new genus *Sextonia* is readily recognized by having clustered leaves and flowers with unequal tepals, characters already mentioned by Rohwer et al. (1991). The differences in wood and bark anatomy between *Ocotea* and *Sextonia* (as *O. rubra*) were amply discussed by Richter (1981), and indeed the main reason that Rohwer et al. (1991) did not describe a new genus to accommodate *O. rubra* was their reluctance to describe another monotypic genus. In a genus as large as *Ocotea* it is not surprising to find individual species or groups of species that differ in one or more morphological characters from the rest of the species, and finding such differences is not a sufficiently strong argument for describing a new genus. However, when such morphological differences are supported by differences in wood and bark anatomy the argument for a new genus is stronger. Three reasons made me consider the generic status of *O. rubra* again. The first is the recent discovery of an undescribed species closely related to *O. rubra*, sharing with it the clustered leaves and flowers with unequal tepals, but differing in having pubescent flowers and racemose inflorescences. This new species has wood and bark anatomy similar to *O. rubra*. Describing this species in *Ocotea* would clearly be incorrect. The second argument is that during a study of the embryology of Lauraceae (Heo et al., in prep.) *Ocotea rubra* was found to differ clearly from the other four investigated species of *Ocotea* in having the mature embryo sac protruding from the nucellus, a character state otherwise only found in *Beilschmiedia*, *Caryodaphnopsis*, *Cryptocarya*, *Endiandra*, and *Potameia*, but lacking in genera considered closely related to *Ocotea*, such as *Aiouea*, *Aniba*, *Cinnamomum*, *Licaria*, *Mezilaurus*, and *Nectandra*. The third is that the inflorescences of the two species of *Sextonia* are different from those found in *Ocotea*. In *Ocotea* the flowers are arranged in cymes, with the lateral flowers of a cyme strictly opposite. In *Sextonia rubra*, however, the flowers are not arranged in cymes. Frequently the ultimate branching of the inflorescences appears racemose and flowers are not strictly opposite. The inflorescence types of Lauraceae and their importance for the suprageneric classification are discussed in detail by van

Figure 1. *Sextonia*. A–H, *S. pubescens* van der Werff; I–K, *S. rubra* (Mez) van der Werff. —A. Habit. —B. Inflorescence. —C. Flower. —D. Pistil. —E. One of the outer 6 stamens. —F. One of the inner 3 stamens. —G. Section through mature fruit. —H. Not fully mature fruit. —I. Mature fruit with cupule. —J. Flower. —K. Leaf.

der Werff and Richter (1996). Thus, the long known morphological differences between *Ocotea* and the proposed genus *Sextonia* are supported by differences in wood and bark anatomy, embryology, and inflorescence type. Therefore, the description of a new genus seems well justified.

Etymology. This genus is dedicated to the late A. J. G. H. Kostermans, an eminent specialist of Lauraceae. The translation of his name in English is sexton, upon which the name *Sextonia* is based.

Sextonia includes two species, which can be separated as follows:

1. Flowers glabrous or nearly so; petioles glabrous; cupule cupshaped, covering at maturity about ⅓ of the fruit . . . . . *S. rubra*
1. Flowers densely pubescent, the hairs ± erect and covering the surface entirely; petioles pubescent; cupule almost completely enclosing the fruit, leaving only a small (5–8 mm) opening at the tip . . . . . *S. pubescens*

Sextonia rubra (Mez) van der Werff, comb. nov. Basionym: *Ocotea rubra* Mez, Jahrb. Koenigl. Bot. Gart. Berlin 5: 258. 1889. *Nectandra rubra* (Mez) C. K. Allen, Mem. New York Bot. Gard. 10: 120. 1964. TYPE: French Guyana, *Melinon s.n.* (holotype, P; isotypes, B, G, K).

Sextonia rubra is a fairly frequently collected species and is known from the Guyanas, Venezuela, and Amazonian Brazil from the Atlantic coast to Manaus.

Sextonia pubescens van der Werff, sp. nov. TYPE: Peru. Loreto: Distr. Iquitos, Allpahuayo, *Vasquez et al. 17660* (holotype, MO; isotypes, AMAZ, B).

Sextoniae rubrae similis, sed floribus pubescentibus, cupula fructum fere omnino includente differt.

Trees, 25 m tall. Twigs terete, thick, densely pubescent at the level of the leaves, becoming glabrous, corky and with conspicuous scars of fallen leaves when older; terminal buds densely pubescent. Leaves clustered at the tips of the branches, elliptic to obovate, 15–25 × 5.5–8 cm, chartaceous, flowering specimen with very young leaves, these 10–13 × 2–3 cm, the base gradually narrowed into the petiole, the apex obtuse, upper surface glabrous, lower surface with some scattered appressed or erect hairs, these denser along midrib and lateral veins, or glabrous; lateral veins 8–12 pairs; midrib and lateral veins immersed on upper surface, raised on lower surface, tertiary venation weakly raised or immersed on both surfaces; petioles sparsely to densely pubescent, 2–2.5 cm long, but petiole poorly differentiated from the decurrent lamina base. Inflorescences densely pubescent, ca. 3 cm long, racemose. Flowers bisexual, densely pubescent, yellow. Tepals 6, erect at anthesis, unequal, outer 3 1.4 mm, inner 3 1.8–2 mm long, densely pubescent outside, sparsely pubescent inside; outer 6 stamens tongue-shaped, ca. 1.6 mm long, pubescent dorsally, anther cells 4, arranged in an arc, the stamens opposite the larger tepals with 2 small glands at the base; inner 3 stamens ca. 1.6 mm long, pubescent, tongue-shaped, with 2 small glands at the base, the 4 cells arranged in two pairs, staminodia 3, triangular, densely pubescent; pistil glabrous, ovary globose, the style very slender; receptacle deep, almost closed at the top, glabrous inside. Fruits enclosed in the enlarged receptacle, at maturity 3 × 3.5 cm, the cupule strongly ribbed and with only a terminal opening of ca. 5–8 mm.

Sextonia pubescens is known only from Amazonian Peru, where it occurs in primary, non-inundated forest. The only known flowering collection had very immature leaves, suggesting that the trees become deciduous shortly before flowering time and that flowers and new leaves appear at the same time. This is not the case in *S. rubra*, where flowers are formed when mature leaves are present. Because only one flowering collection is known for *S. pubescens*, the size of the inflorescence and its racemose character might not be constant for the species; additional collections may well have larger and more branched inflorescences. The floral measurements are taken from alcohol-preserved flowers; measurements made from dried flowers will give smaller values. The three fruiting collections from Allpahuayo have larger fruits than the Schunke Vigo collection, but the cupules of these fruits have a smaller terminal opening. Of the fruits illustrated in Figure 1, those depicted in Figure 1A and H come from the Schunke Vigo collection, while Figure 1G comes from a collection from Allpahuayo. Although I assume that these differences are related to the maturity of the fruits, this has not yet been conclusively demonstrated.

Paratypes. PERU. **San Martin:** Distr. Tocache Nuevo, *Schunke Vigo 7439* (MO). **Loreto:** Distr. Iquitos, Allpahuayo, *Vasquez & Jaramillo 11449 & 18246* (MO), *Vasquez et al. 13772* (MO), *van der Werff & Vasquez 13826* (MO).

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Notes on the Lowiaceae, Musaceae, and Zingiberaceae for the *Flora of China*

WU Te-lin
South China Institute of Botany, Chinese Academy of Sciences,
Guangzhou, Guangdong 510650, People's Republic of China

ABSTRACT. A new combination in the Lowiaceae, *Orchidantha chinensis* T. L. Wu var. *longisepala* (D. Fang) T. L. Wu, as well as a new species, *Alpinia jianganfeng* T. L. Wu, and two new combinations, *Amomum petaloideum* (S. J. Tong) T. L. Wu and *Roscoea cautleoides* Gagnepain var. *pubescens* (Z. Y. Zhu) T. L. Wu, in the Zingiberaceae are proposed. Eight species names in the Lowiaceae, Musaceae, and Zingiberaceae are reduced to synonymy.

The following novelties are proposed to make the names available for the treatments of Lowiaceae, Musaceae, and Zingiberaceae in the forthcoming volume 24 of the *Flora of China*.

LOWIACEAE

Orchidantha chinensis T. L. Wu var. **longisepala** (D. Fang) T. L. Wu, comb. et stat. nov. Basionym: *Orchidantha longisepala* D. Fang, Guihaia 16: 4. 1996. TYPE: China. Guangxi: Shangsi, Baibao, Nadang, Shiwandashan, 370 m, 9 Mar. 1975, *D. Fang & X. X. Chen 35125* (holotype, GXMT; isotypes, IBK, IBSC, PE).

Orchidantha longisepala differs from *O. chinensis* only in the flower size. The former has sepals 12–17 × 1.9–3.2 cm, a labellum 12–17 × 2–2.3 cm, and two lateral petals 2.8–3.2 cm long. In contrast, *O. chinensis* has sepals ca. 9.5 × 1.5–2 cm, a labellum ca. 9 × 0.8 cm, and two lateral petals ca. 2 cm long. These quantitative differences can justify the recognition of *O. longisepala* at only varietal rank.

MUSACEAE

Musa balbisiana Colla, Men. Gen. Musa 56. 1820.

Musa dechangensis J. L. Liu & M. G. Liu, Act. Bot. Yunnan. 9: 163. 1987. Syn. nov. TYPE: China. Sichuan: Dechang, Xiaogao, 1380 m, 2 Dec. 1984, *J. L. Liu & J. Q. Xiao 179* (holotype, XIAS).

Musa lushanensis J. L. Liu, Acta Bot. Yunnan. 11: 171. 1989. Syn. nov. TYPE: China. Sichuan: Lushan Xian, Shuangshixiang, 700 m, 3 Oct. 1987, *J. L. Liu & Z. H. Tang 181* (holotype, XIAS).

Musa luteola J. L. Liu, Invest. & Stud. Nat. 10: 41. 1990. Syn. nov. TYPE: China. Sichuan: Yaan, Lushan Xian, Shuangshixiang, 700 m, 3 Oct. 1987, *J. L. Liu & Z. H. Tang 180* (holotype, XIAS).

Musa dechangensis, *M. lushanensis*, and *M. luteola* are indistinguishable from *M. balbisiana* in almost all aspects of bracts, fruit, and seeds. The slight differences given by the authors of these three names (e.g., having yellowish bracts or lacking the fruit beak) can be observed within *M. balbisiana* and, therefore, do not support the recognition of these three variants as independent species.

Ensete wilsonii (Tutcher) Cheesman, Kew Bull. 2: 103. 1948.

This species was treated by Li (1981) as *Musa wilsonii* Tutcher. However, a study of the figure and the description in the original publication of *M. wilsonii* clearly reveals that the species should be placed in *Ensete* and not *Musa*. *Ensete*, including *E. wilsonii*, differs from *Musa* in having a sympodial swollen stem base (vs. stoloniferous stem base), a 3-lobed compound tepal (vs. 5-toothed compound tepal), green (vs. colored) bracts, and seeds 1–1.3 (vs. less than 0.6) cm in diameter.

ZINGIBERACEAE

Alpinia hainanensis K. Schumann, in Engler, Pflanzenr. IV. 46(Heft 20): 335. 1904.

Alpinia henryi K. Schumann, in Engler, Pflanzenr. IV. 46(Heft 20): 335. 1904. Syn. nov. TYPE: China. Hainan: without locality, *Henry 8402* (holotype, B; isotype, K).

Alpinia katsumadai Hayata, Icon. Pl. Formosan. 5: 224. 1915. Syn. nov. TYPE: China. Hainan: without locality, 1910, *Katsumada s.n.* (holotype, TI).

Alpinia kainantensis Masamune, Trans. Nat. Hist. Soc. Taiwan 33: 28. 1943. Syn. nov. TYPE: China. Hainan (as Kainanto): Man-nei, 27 Nov. 1940, *Masamune & Fukuyama 174* (holotype, TI).

The types of all of the above four names were collected from Hainan Island. A comparison of the original descriptions, as well as photographs of the type

collections of both *Alpinia hainanensis* and *A. henryi*, cast no doubt that all four represent a single species.

Alpinia stachyodes Hance, J. Linn. Soc., Bot. 13: 126. 1873.

Alpinia densibracteata T. L. Wu & Senjen, Acta Phytotax. Sin. 16(3): 32. 1978. Syn. nov. TYPE: China. Guangdong: Long Men, *W. T. Tseng 25332* (holotype, IBSC).

An examination of the types of *Alpinia stachyodes* and *A. densibracteata* reveals that a single species is involved.

Alpinia (subg. *Probolocalyx* K. Schumann) **jianganfeng** T. L. Wu, sp. nov. TYPE: China. Guangdong: Lian Nan Xian, *Z. S. Zhu 784* (holotype, IBSC).

Caulis ca. 1 m altus; folia lanceolata vel lineari-lanceolata, 20–30 cm longa, 2–4(–6) cm lata; ligula bifida, ca. 2 mm longa, ciliata; spica terminalis, 10–20 cm longa; rhachidi tomentosa; bracteola minuta; calyx cylindricus, apice tridentatus pubescens; corollae tubus 8–10 mm longus, lobis oblongis, 8–10 mm longis, villosis; staminodia lateralia lineares, ca. 2 mm longa; labellum obovatum, 0.7–1.3 mm longum, margine crispatum, apice bifidum; stamen labello longior; capsula globosa 7–8 mm diam., pubescens, apice calyce persistenti coronata; semina 5–6.

Plants herbaceous. Stems ca. 1 m long. Leaves sessile or with petioles to 4 cm; sheath glabrous; ligule ca. 2 mm long, 2-cleft, ciliate; leaf blade lanceolate to linear-lanceolate 20–30 cm long, 2–4(–6) cm wide, glabrous except for hispid subapical margin, base attenuate, apex narrowly caudate. Spikes terminal, erect, 10–20 cm long; rachis tomentose; bracts absent; bracteoles minute. Flowers in clusters of 3. Calyx cylindric, apex 3-cleft, pubescent outside. Corolla tube subequal or slightly longer than calyx; lobes oblong, 8–10 mm long, villous outside. Lateral staminodes linear, ca. 2 mm long. Labellum obovate, 0.7–1.3 cm long, margin crispate, apex 2-cleft. Stamen longer than labellum; anther ca. 4 mm. Ovary globose, pubescent. Capsule globose, 7–8 mm diam., pubescent, apex crowned with persistent calyx. Seeds 5 or 6.

Flowering April–June, fruiting June–November.

Alpinia jianganfeng is closely related to *A. bambusifolia* C. F. Liang & D. Fang, from which it differs in having glabrous sheaths, spikes 10–20 cm long, flowers in fascicles of 3, and a labellum 7–13 mm long with a crispate margin. In contrast, *A. bambusifolia* has pubescent sheaths, spikes 1.5–6 cm long, flowers in pairs or solitary along upper parts of the spike, and an entire labellum ca. 9 mm long.

Alpinia jianganfeng was misidentified by Wu and Chen (1981) as *A. stachyodes* Hance. However, the latter species has tomentose sheaths, ligules ca. 1 cm long, ovate or lanceolate bracts 1.5–2.5 cm long, lanceolate bracteoles 5–10 mm long, and a rhombic-ovate obscurely 3-lobed labellum. Plants of *A. jianganfeng* have glabrous sheaths, ligules ca. 2 mm long, no bracts, minute bracteoles, and an obovate 2-cleft labellum.

Paratypes. CHINA (all specimens at IBSC). **Guangdong:** Lian Nan Xian, *T. S. Chu 784*; Nan Xiong Xian, *L. Deng 6375* (IBS); Tai San Xian, *B. H. Chen 881*; Xin Feng Xian , *H. G. Ye 1000*; Ying De Xian, *C. S. Niu 8031*; Yu Nan Xian, *G. C. Zhang 2760*. **Guangxi:** Bai Shi Xian, *Y. W. Taam 8*; Cang Wu Xian, *S. H. Chun 229138*; He Xian, *Y. K. Li*; Rong Xian, *S. H. Chun 229138*. **Hong Kong:** *W. Y. Chun 4876*; *Y. Tsiang 647*. **Hunan:** Jiang Hua Xian, *B. G. Li 05328*; Yi Zhang Xian, *S. H. Chun 2900*. **Jiangxi:** Hui Chang Xian, *C. M. Hu 3393*; Le Yi Xian, *M. X. Nie 8609*; Xu Wu Xian, *C. M. Hu 1658*; Yong Xin Xian, *S. K. Lai 4978*.

Amomum petaloideum (S. Q. Tong) T. L. Wu, comb. nov. Basionym: *Paramomum petaloideum* S. Q. Tong, Acta Bot. Yunnan. 7: 310. 1985. TYPE: China. Yunnan: Mengla Xian, Meng-lun, 620 m, 10 June 1981, *S. Q. Tong 24801* (holotype, YNTBI).

In his original description of the monotypic *Paramomum*, Tong (1985) compared it with *Costus*. However, *P. petaloideum* has all the features of *Amomum*.

Roscoea cautleoides Gagnepain var. **pubescens** (Z. Y. Zhu) T. L. Wu, comb. et stat. nov. Basionym: *Roscoea pubescens* Z. Y. Zhu, Acta Phytotax. Sin. 26: 315. 1988. TYPE: China. Sichuan: Xichang, 2000 m, *J. L. Zhang 195* (holotype, EMA).

Except for having pubescent sheaths and abaxial leaf surfaces and slightly longer fruits, plants of *Roscoea pubescens* are indistinguishable from those of *R. cautleoides*.

Roscoea humeana I. B. Balfour & W. W. Smith, Notes Roy. Bot. Gard. Edinburgh 9: 122. 1916.

Roscoea sichuanensis Miau, Act. Sci. Nat. Univ. Sunyatseni 34(3): 81. 1995. Syn. nov. TYPE: China. Sichuan: Mt. Siga, overlooking Yalang River, N Koradi, 12,000 ft., May 1932, *J. F. Rock 23852* (holotype, SYS; isotype, A).

An examination of the type material of *Roscoea sichuanensis* reveals that the plant is indistinguishable from *R. humeana*.

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Notes on Gymnosperms II. New Taxa and Combinations in *Juniperus* (Cupressaceae) and *Ephedra* (Ephedraceae) from China

YU Yong-Fu and FU Li-Kuo

Institute of Botany, Chinese Academy of Sciences, 20 Nanxincun, Xiangshan, Beijing 100093, People's Republic of China

ABSTRACT. Two new species, *Juniperus chengii* L. K. Fu & Y. F. Yu and *J. baimashanensis* Y. F. Yu & L. K. Fu, and three new varieties, *J. pingii* Cheng ex Ferre var. *carinata* Y. F. Yu & L. K. Fu, *J. squamata* Buchanan-Hamilton ex D. Don var. *parvifolia* Y. F. Yu & L. K. Fu, and *J. squamata* var. *hongxiensis* Y. F. Yu & L. K. Fu, are described. Two new combinations in *Juniperus* and one in *Ephedra* are proposed.

As a result of our work on the gymnosperms for the *Flora of China*, the following novelties are proposed to make the names available for the forthcoming account of that flora.

Juniperus chengii L. K. Fu & Y. F. Yu, sp. nov. TYPE: China. NW Yunnan: Zhongdian, 3150 m, 15 Nov. 1937, *T. T. Yü 10960* (holotype, PE; isotype, A).

Arbor ca. 3–9 m alta, ramulis foliatis gracilibus, 1.1–2 mm crassis, quadrangulatis vel sexangulatis; folia decussata vel verticillata, arcte adpressa, ovata, valde arcuata, 1–2 mm longa, 0.5–1.2 mm lata, dorse obtusiuscule porcatis, lucidis; strobili maturi purpureo-nigri, oblongi vel globosi, 0.9–1.1 cm longi, ca. 9 mm lati.

Trees 3–9 m tall. Leafy branchlets thin, 4- or 6-angled, 1.1–2 mm diam., usually arched. Leaves decussate or in whorls of 3, closely appressed, ovate, 1–2 × 0.5–1.2 mm, strongly arched, adaxially concave, abaxially bluntly ridged, lustrous, base decurrent, apex obtuse or pointed. Seed cones purplish black at maturity, oblong to globose, 0.9–1.1 cm, ca. 9 mm diam., 1-seeded. Seeds triangular-ovoid, ca. 9 mm, ca. 7 mm diam., ridged.

Juniperus chengii, which is named in honor of Cheng Wan-Chun (1904–1983) for his outstanding contribution to the taxonomy of gymnosperms, is distinguished from the remaining Chinese species of *Juniperus* by its smaller (1–2 mm) leaves that are decussate or in whorls of 3, and its 4- or 6-angled branchlets.

Juniperus baimashanensis Y. F. Yu & L. K. Fu, sp. nov. TYPE: China. NW Yunnan: Deqin, 3400 m, 9 Aug. 1937, *T. T. Yü 9462* (holotype, PE).

Species affinis *J. pingii* Cheng ex Ferre, sed foliis dorse obtusiuscule porcatis, sulcatis secus porcas, ramulis foliatis longioribus, rectioribus, laxioribus, fere parallelis differt.

Shrubs ca. 60 cm tall. Branches glaucous; leafy branchlets ascending, thin, long, usually straight, loosely arranged and almost parallel. Leaves in whorls of 3, ascending, acicular, 4–6 × ca. 1 mm, straight or slightly incurved, adaxially concave, with a white stomatal band and without a green midvein, abaxially bluntly ridged, with thin grooves along ridges, base decurrent, apex acuminate, sharp pointed. Seed cones brownish black at maturity, globose, ca. 6 mm, ca. 6 mm diam., 1-seeded. Seeds triangular-ovoid, ca. 5 mm, ca. 5 mm diam.

Juniperus baimashanensis differs from *J. pingii* by its bluntly ridged leaves with grooves along the ridges, and its longer, straight, loosely arranged and almost parallel branchlets. *Juniperus pingii* has conspicuously ridged leaves without grooves along the ridges and shorter, curved, densely and irregularly arranged branchlets.

Juniperus pingii Cheng ex Ferre var. **carinata** Y. F. Yu & L. K. Fu, var. nov. TYPE: China. W Sichuan: Yajiang, 4460 m, 26 Apr. 1960, *T. S. Ying 3140* (holotype, PE).

A var. *pingii* recedit fruticibus, raro arboribus parvis, ramulis foliatis validis, non pendulis. *J. pingii* var. *wilsonii* (Rehder) Y. F. Yu & L. K. Fu similis, sed foliis longioribus, rectis vel leviter incurvis, ramulis foliatis vulgo non sexangulatis differt.

Variety *carinata* differs from variety *pingii* in being shrubs or rarely small trees and in having stout, ascending or spreading branchlets, whereas plants of variety *pingii* are trees with slender pendulous branchlets. It is distinguished from variety *wilsonii* by its longer, straight or slightly incurved and as-

cending leaves; in variety *wilsonii* the leaves are shorter, strongly incurved, and appressed.

Paratypes. CHINA. **W Sichuan:** Kangding, 4000 m, 29 July 1963, *K. C. Kuan et al. 1070* (PE), 3200 m, 13 Sep. 1953, *H. L. Tsiang 36824* (PE), 2700 m, 1 Oct. 1928, *W. P. Fang 3695* (PE). **NW Yunnan:** Deqin, 2700 m, Sep. 1935, *C. W. Wang 70157* (PE); Zhongdian, 3800 m, 14 Oct. 1955, *K. M. Feng 21054* (PE).

Juniperus squamata Buchanan-Hamilton ex D. Don var. **parvifolia** Y. F. Yu & L. K. Fu, var. nov. TYPE: China. SW Sichuan: Puxiong, 3600–3700 m, 17 May 1959, *C. T. Kuan 9613* (holotype, PE).

A var. *squamata* foliis parvioribus, 2.5–3.5 mm longis, valde arcuatis differt.

The new variety differs from variety *squamata* by its strongly curved, smaller leaves 2.5–3.5 mm long. In variety *squamata* the leaves are longer (5–7 mm) and straight or slightly curved.

Paratype. CHINA. **SW Sichuan:** Yuexi, 3200 m, 13 July 1959, *Sichuan Econ. Pl. Exp. 3944* (PE).

Juniperus squamata Buchanan-Hamilton ex D. Don var. **hongxiensis** Y. F. Yu & L. K. Fu, var. nov. TYPE: China. SW Sichuan: Hongxi, 3640 m, 5 Aug. 1959, *Sichuan Econ. Pl. Exp. 1624* (holotype, PE).

A var. *squamata* recedit ramulorum internodiis conspicue expositis, foliis laxioribus, parvioribus, 3.5–4.5 mm longis, arcuatis.

Juniperus squamata var. *hongxiensis* is easily distinguished from variety *squamata* by its conspicuously exposed internodes and smaller, curved, loosely arranged leaves. Variety *squamata* has covered internodes and larger, straight or slightly curved, densely arranged leaves.

Juniperus sabina L. var. **yulinensis** (T. C. Chang & C. G. Chen) Y. F. Yu & L. K. Fu, comb. nov. Basionym: *Sabina vulgaris* Antoine var. *yulinensis* T. C. Chang & C. G. Chen, Acta Phytotax. Sin. 19: 263. 1981. TYPE: China. N Shaanxi: Shenmu, 1100 m, *T. C. Chang & C. G. Chen 77701* (holotype, WUG).

Variety *yulinensis*, which is restricted to N Shaanxi (Shenmu, Yulin), differs from variety *sabina* in having seed cones borne on straight branchlets. In the widespread variety *sabina*, the seed cones are borne on curved branchlets.

Juniperus sabina L. var. **erectopatens** (Cheng & L. K. Fu) Y. F. Yu & L. K. Fu, comb. nov. Basionym: *Sabina vulgaris* Antoine var. *erectopatens* Cheng & L. K. Fu, Acta Phytotax. Sin. 13: 86. 1975. TYPE: China. N Sichuan: Songpan, 2700 m, *T. T. Yü 2702* (holotype, PE).

Plants of variety *erectopatens* differ from those of variety *sabina* by being trees with branchlets bearing seed cones straight and shorter and by having (1- or)2-seeded seed cones. It differs from variety *jarkendensis* in having densely arranged, thinner branchlets ca. 0.8 mm in diameter and light brownish green seed cones that are (1- or)2-seeded when mature.

Ephedra likiangensis Florin var. **mairei** (Florin) L. K. Fu & Y. F. Yu, comb. et stat. nov. Basionym: *Ephedra saxatilis* Royle ex Florin var. *mairei* Florin, Kongl. Svenska. Vetenskapsakad. Handl. ser. 3, 12(1): 33. 1933. TYPE: China. Yunnan: Lijiang. *J. F. Rock 10824* (holotype, W; isotype, A).

Ephedra likiangensis var. *mairei* differs from variety *likiangensis* by being small herbaceous shrubs 15–25 cm tall and without conspicuous main stems above ground, and by having woody stems procumbent or buried in soil.

Although Florin (1933) described variety *mairei* as a variety of *Ephedra saxatilis*, the plant is more similar to *E. likiangensis*, especially in having seed cones with short peduncles, seeds enclosed by an uppermost pair of bracts at maturity, and pollen cones with fewer bracts. Cheng (1978) treated variety *mairei* as a form of *E. likiangensis*, but the differences between the two taxa are sufficient to treat the former at the varietal rank.

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Erratum

Dressler, R. L. 1997. New species and combinations in Costa Rican orchids. Novon 7: 124.

The combination *Stellilabium lankesteri*, proposed on page 124 is redundant. It had been made earlier by L. O. Williams in Brittonia 14: 446. 1962.

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